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ELECTRICAL WORLD

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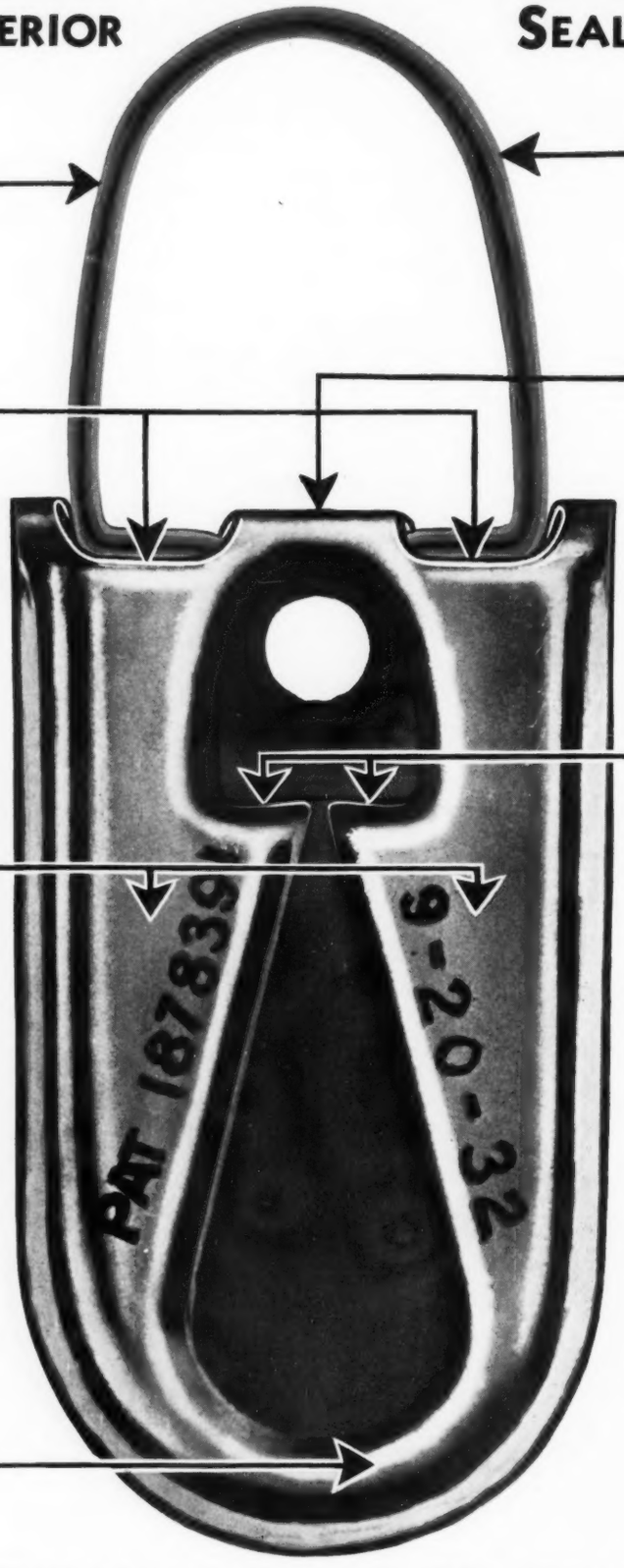

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BROOKLYN, NEW YORK

ELECTRICAL WORLD

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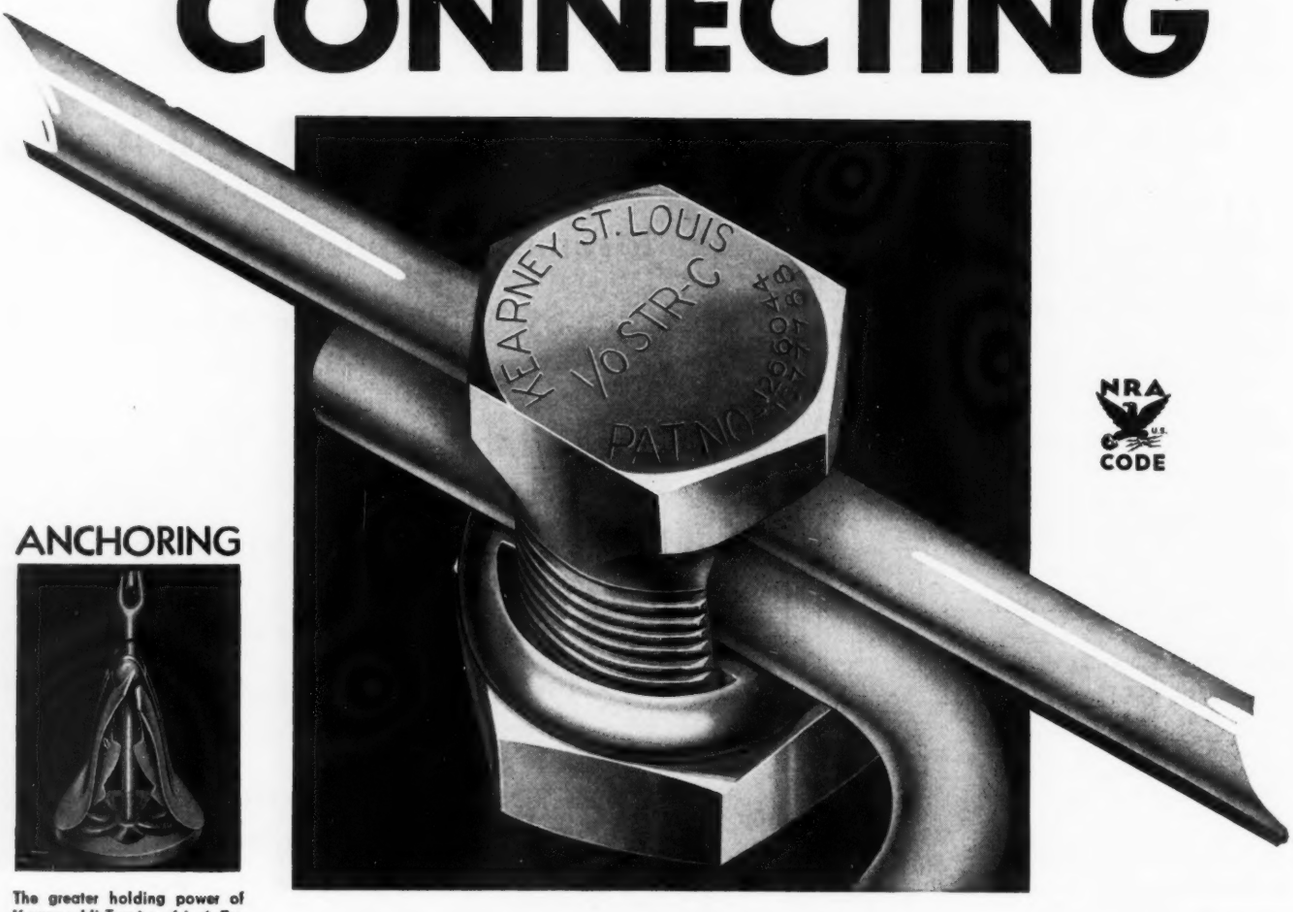

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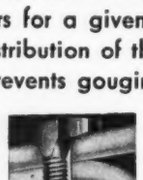

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ELECTRICAL WORLD

Established 1874—McGraw-Hill Publishing Company, Inc.

for the Week Ending

August 11, 1934

L. W. W. MORROW, *Editor*

Dam Conscious or Sales Conscious?

"WE ARE going to see electricity and power made so cheap that they will be a standard article of use, not only for agriculture and manufacturing, but also for every house within reach of an electric light line . . . we cannot have too much power and the power that we are developing is going to be controlled by the government for all time." These statements of President Roosevelt in his speeches last week state his power policy. They lie back of the commitments of about $1,000,000,000 of taxpayers' money to be invested in the power business.

No one in the electrical industry will take issue with his desire to electrify America. This has been the goal of the electrical utilities for many years and they are proud of their record in developing and selling power. But they have faced practical handicaps in endeavoring to carry out their objectives that also will face the government. Any one can make power in any quantity in this country and sell it at a low price if it is used in quantity. But low rates and plenty of power do not make volume sales. Electric power is competitive, electrical equipment for homes and factories costs money, even at low rates electricity necessitates consumers paying money for service. The power problem lies in the marketplace; not in making the "American people dam-conscious."

An unbiased report of the U. S. Chamber of Commerce just made public recognizes these practical aspects. "With lighting and small appliances for the household, electricity has no competitor. Services requiring a large amount of heat like cooking, water heating and space heating are large current consumers suggesting the practicability of low rates, but in these fields of home service coal, gas, oil and other fuels are well intrenched." Also, "the general electrification of our homes would require an investment of fifteeen or twenty billions of dollars for appliances alone, not including air conditioning. Even with substantial reductions in equipment cost and energy cost, it is questionable whether the economic status of the potential electrified home customers is such that the growth of home electrification can be greatly accelerated, unless forced by some artificial stimulus such as a government subsidy."

UNDER private enterprise, these practical aspects of the business are known. The industry knows that it must sell to lower incomes, against greater competition, with increased costs and with lower rates. It is doing this as a practical business activity, and at the current time the utilities were never more active in going after business. But the industry is going after business with its eyes open and with a realization of all the elements that must be evaluated. It is not day dreaming with the idea that cheap power and plenty of power of themselves will electrify America.

We heartily agree with the ambition of President Roosevelt to electrify America. We disagree with the conclusions that the government yardsticks authorized are necessary, will produce cheap power or will accomplish any more vital or significant results in selling electricity than those already accomplished and still being recorded by the privately owned utilities. The true yardstick for measuring the possibilities of the electrical business is the competitive situation and the purchasing power found on the customers' premises. No amount of "dam-consciousness" will offset this fact.

Should Motors Be Run to the Breakdown Point?

Industrial engineers responsible for continuous processes will answer this question in the negative if they believe in preventive maintenance, but since the policy of running electrical equipment to the point of failure actually prevails in some instances it is apparent that a unanimous vote cannot as yet be obtained in favor of inspection and anticipatory repair work. In one case recently seen, the plant engineer made the point that electric motor and control apparatus is now so well built that it may be possible to get at least a decade of service out of it before replacing it with new equipment. Meanwhile the factory lets contacts in starting boxes alone if they give no trouble; has no use for periodic testing of motor insulation or air-gap dimensions, and maintains enough spare motors on hand to replace quickly any "bad actors" in its production lines.

This policy looks extremely vulnerable to engineers accustomed to mechanical and electrical prophylaxis, but it renews inquiry as to the possibility of establishing closer control of such work on the basis of more acute analysis of equipment performance, product volumes and costs in place of rule-of-thumb inspection and repair cycles. The economics of maintenance bristles with inquiries which the industrial electrical engineer will be obliged to answer more definitely than ever in the years immediately ahead. Fortunately instruments and methods are ready to render powerful aid in such work.

A New Idea for Water Heating

Danzig is about to have a plant which will produce hydrogen and oxygen at high pressure by electrolyzing water with off-peak energy. The cost is expected to be 6 cents per cubic meter—one-fifth what it has been. That, of course, is on a large-scale basis of operations. The great virtue of the new process is that it makes it possible to generate the gases at 160 atmospheres and therefore dispenses with mechanical compression.

This news prompts a dream of domestic water heating in the days ahead. Instead of storing the heat in the water itself by direct application of electric heat in off-peak hours it may ultimately prove feasible to store the two gases at high pressure and burn them as a continuous flame in a modified type of gas heater at low pressure. By electrolysis the two gases are inherently produced in just the proportions in which they recombine during combustion to produce water vapor. There will be problems of rectification, of safety in withstanding the requisite pressures, of mixing valves and of explosion hazards. If these could be solved at moderate costs many of the problems of reinforced distribution wiring, of interior wiring and of two-rate metering would be solved too.

Lines are not working hard from midnight to dawn. How about accumulating fuel gases from a cheap commodity (water) with cheap energy (off-peak), provided the apparatus can be made to cost no more than heater units plus relagged tanks plus extra copper and extra transformer capacity? It is entirely a question of ingenuity, dollars and conversion efficiencies.

Rehabilitation Gadgets Sell

Gimcrack and gadget are contemptuous terms occasionally applied by narrow-minded mechanicians to electrical devices other than conventional apparatus like motors, transformers and knife switches. Such ancestor worshipers are rapidly getting fewer, but there are still too many who merely tolerate (rather than capitalize with enthusiasm) the intrusion into and superposition of electrical accessories into mechanisms that perform a primarily mechanical function. If they could see what the already converted know they would drop their isolationism quickly.

Concerns which specialize in clever automatic machinery live and thrive by salvaging decadent establishments which try to hold blindly to 1880 equipment and 1900 methods. The intricate gimcracks and gadgets which they devise for their clients prove to be the very thing which permits them to revive and survive competition. Unfortunately business ethics prevents these specialty concerns telling about the wonders they perform.

Not by any means are all these devices extensive, elaborate and intricate. There are hundreds of partially mechanized industries which could make a dollar go farther in production by incorporating simple limit switches, trips, controls, counters, selectors, etc. That is a perfectly fair way of taking advantage of one's competitors, NRA code or not. The industrial engineer who fails in this tense period to watch for gadgets and gimcracks is thereby losing his place in the procession.

San Joaquin's Adventure in "Free Electricity"

Final detailed report on this unique promotion plan— How domestic, commercial and agricultural customers respond

A. E. WISHON
President
San Joaquin Light & Power Corporation

H. H. COURTRIGHT
President
Valley Electrical Supply Company

RETURNS are now in from the San Joaquin Light & Power Corporation's recent adventure in giving away energy to promote a larger use by customers. Soon after the first announcement of the plan a non-electrical journal published an editorial which began: "The electric utilities are going in for confounded heresy these days." But A. Emory Wishon, president of the San Joaquin company, says: "It is with consummate pleasure that I am able to announce that our 'heretical' offer has paid us well."

"The offer was made," Mr. Wishon stated, "because business had been on the decline and we were in consequence earning less than was contemplated when rate reductions were effected in 1932. The company was in no position to stand a drastic reduction in income. What we have sought was a means by which we could give our customers more for their money and still maintain our revenues at a necessary level. The plan was based upon these simple facts and with the thought that this privilege of free use for a trial period would demonstrate the value of permanent additional use. Now that the results of the offer are available, we find that our greatest expectations have been exceeded, both by the San Joaquin Light & Power Corporation and the Midland Counties Public Service Corporation, an affiliate.

"Actually, not one but two offers were made simultaneously. The first, free electricity, entitled all domestic consumers and commercial lighting customers to unlimited use of service for May and June for a monthly charge not greater than the March bill. The second, known as the special use offer, was made to agricultural power consumers, who, for these two months, could use power in excess of that used by them during the corresponding period of 1933 and pay only half the regular rate for the excess."

The direct and immediate results of the offers, as related by Mr. Wishon, are these:

First, a total of 43,224 domestic and commercial lighting customers, or 52.9 per cent of those eligible, took advantage of the offer, using 5,633,911 free kilowatt-hours. This use was 40.5 per cent of the kilowatt-hours paid for at the regular rates.

Second, 10,726 agricultural power consumers, or 69 per cent of the total, used 21,212,599 kw.-hr. in excess of their last year's consumption for the two special use months. This use, an increase of 102 per cent over the kilowatt-hours paid for at the regular rate, was billed at half price, subject to refund of even this charge if the regular use for the agricultural year exceeds 4,000 kw.-hr. per horsepower.

Third, personal calls on 18,000 domestic and commercial consumers to explain the plan found almost universal acceptance and appreciation.

Fourth, merchants and dealers report sales of electrical merchandise in the territory as double to four times sales last year.

Fifth, the total cost of the campaign, including increment power costs, special advertising and sales work, has been fully offset by increased sales. Our consumers were given more for their money and our net income was increased.

"Yet, this undeniably good record is not the full test of the success of our offer," Mr. Wishon points out. "Free electricity, as we originally conceived it, was the first part of a two-part plan which included the new lower rate offer. The primary consideration was the maintenance of revenue in the face of a reduction in rates. Free electricity was the sample-giving part of the plan; its important function was to break the habit

When the San Joaquin Light & Power Corporation announced last spring that it would give away free electricity to its consumers during May and June the industry gasped. Apparently here was promotion gone wild. But, despite the hue and cry, it went ahead and now presents the results of the experiment. They offer an interesting study embracing customer reaction, trade relations and increased load.

Who Used the "Free Electricity?"

Class of Customers	Month	Total Consumers	% Using Free Elec.	Kw.-Hr. at Regular Rate	Kw.-Hr. Supplied Free	Ratio of Free Kw.-Hr. to Kw.-Hr. Sold	Kw.-Hr. of Free Use per Free Use Consumer
Domestic Lighting.	May	59,872	49.5	2,393,454	698,102	29.2	23.5
	June	59,619	50.8	2,378,801	845,265	35.6	27.9
Average.....	2 mo.	59,695	50.2	4,772,255	1,543,367	32.5	25.7
Domestic Heat. and Cook	May	9,929	75.4	1,939,345	1,335,516	69.0	176
	June	9,978	78.5	1,973,701	1,580,622	80.1	202
Average.....	2 mo.	9,954	77.0	3,913,046	2,916,138	74.3	190
Commercial Lighting	May	11,014	47.0	2,042,250	523,732	25.6	101
	June	11,138	49.0	2,053,643	622,944	30.3	115
Average	2 mo.	11,076	48.0	4,095,893	1,146,676	28.0	106
Public Building....	May	796	28.2	209,679	11,653	5.6	52
	June	774	27.3	190,202	10,718	5.6	51
Average	2 mo.	785	27.8	399,881	22,371	5.6	51
Outdoor Blinkers ..	May	213	11.3	384,091	2,053	0.5	85
	June	215	15.8	374,360	3,306	0.9	97
Average.....	2 mo.	214	13.5	758,451	5,359	0.7	92
Total.....	May	81,824	52.1	6,968,819	2,571,056	37.0	60
Total.....	June	81,724	53.7	6,970,705	3,062,855	44.1	70
Average.....	2 mo.	81,774	52.9	13,939,524	5,633,911	40.6	65

This tabulation does not show how many individual consumers used the free energy in either month, but it is obvious that it must have been more than the average of two months. Probably 60 per cent of the consumers participated.

What the Farm Customers Did

Total agricultural power consumers.....	15,393
Consumers who had "special use"	10,726
Per cent of consumers who had "special use".....	69.0
Total connected load, horsepower.....	204,446
Connected load operating on "special use," horsepower.....	125,178
Per cent of connected load operating on "special use".....	61.0
Total kilowatt-hours at regular rates.....	20,639,737
Total kilowatt-hours of "special use" (half price).....	21,212,599
Ratio of "special use" kilowatt-hours to kilowatt-hours sold at regular rates, per cent.....	102.0
Kilowatt-hours of "special use" per consumer who had "special use".....	1,980
Kilowatt-hours of "special use" per horsepower operated on "special use"..	170

A "special use offer" was extended to all agricultural consumers during May and June permitting them to use all excess over the same period last year at one-half the regular rate.

of domestic economy and to pave the way for a greater acceptance of the lower rate offer."

H. H. Courtright, president and manager of the Valley Electrical Supply Company, the utility's merchandising division, interprets the figures shown in the accompanying table. "In almost every instance," he says, "the figures for the second month are better than those for the first. Apparently, the cumulative effect of the campaign gradually convinced customers that 'something for nothing' was here a reality. For both months the kilowatt-hour output jumped approximately one-fourth above that for March. Naturally, it was forced load and much of it vanished as soon as it represented a customer expense, but a good portion of it will remain as a lasting increase, for three reasons: First, some customers purchased new appliances as a result of the intensive promotional campaign; second, other customers, without cost, tasted the convenience which the use of additional electricity brings, and, third, more than half of the customers proved to themselves that they can use more electricity to advantage.

"The 25 per cent increase in load was registered by the action of only half the customers eligible, so that the customers who used free electricity really increased their use by about 50 per cent, on the average. These were domestic lighting customers—representing 73 per cent of the total customers in all classifications.

"Examining the domestic cooking and heating figures," Mr. Courtright continues, "it can be seen that 77 per cent of the customers used 69 per cent more electricity than all the consumers in this classification did in March, so that those who used free electricity must have used nearly 90 per cent more kilowatt-hours on the average. Of course, the use of refrigerators with the advent of warm weather was responsible for some of the increase in both classifications, but a refrigerator in May or June will not use 190 kw.-hr. more than it did in March. These customers actually used their appliances more, increased their lighting, rediscovered the convenience, economy and necessity of electricity. They proved to themselves what we have known and preached, but what they refused to believe—that they haven't yet started to realize the benefits from their appliances.

"The tremendous increase in kilowatt-hour sales to agricultural power customers was due in large part to the weather. This has been a dry year in central California, with little snow in the mountains and only slight rainfall. Summer came sooner than usual. The combination of little or no ground water and hot days in March and April made early irrigation pumping necessary, so the special use offer was a godsend to the farmers, and more than two-thirds were able to take advantage of it.

Consumer facts gained

"Let's look at it in another way. In 1933 the average annual consumption per domestic customer was 912 kw.-hr. During the two months of free electricity domestic consumption increased 31.6 per cent. With no appliances other than those used during this offer, then, the domestic customers should be able to increase their consumption to 1,200 kw.-hr. annually. Here, for the first time, is a definite basis on which we can work. We know our domestic customers can use an average of 1,200 kw.-hr. annually with present equipment, because they have proved it! And that knowledge is valuable."

Nearly every appeal was used in the campaign to interest commercial lighting customers, but the appeal to civic pride proved most effective. The power company commercial lighting department, augmented at the beginning of the campaign, and the district managers contacted chambers of commerce and similar civic organizations and induced them to foster what were known as "white nights" or "light-up campaigns." In some cities petitions were circulated and store owners signed to keep lights burning until midnight, or, in some cases, all night. One furniture store boosted its consumption from 200

kw.-hr. in March to more than 1,800 kw.-hr. in May. The General Electric Company sponsored window lighting contests in key cities throughout the system. Commercial lighting men made night traffic counts and procured splendid selling information. Smaller lamp sizes were replaced with 200-, 300- and 500-watt lamps. Fixtures which had been in disuse for reasons of economy again were lighted. Signs were lighted earlier, turned off later at night. In one city street lights in the downtown section were turned on, connected to the commercial lighting meters in adjacent stores. Nearly half of the commercial lighting customers became free electricity users, and did a better-than-usual lighting job.

Community approves trial

Intangible effects on public and dealer relations, as well as the use of free electricity and the purchase of new equipment, were reflected in the interviews with customers. Out of 15,907 calls to explain the plan, 12,576 brought favorable responses, 2,718 showed an unwillingness to commit themselves in advance of actual trial, while only 584 were found to have an unfavorable or skeptical reaction. Intention to take advantage of the offer was announced by 8,533—53 per cent of the total, which checks closely with the actual result. After the plan was under way a follow-up check on 1,983 customers showed an even more favorable reaction.

Near the end of the offer, 8,639 interviews were made to announce the new lower rate offer, and of this number 7,547 were favorable to the new plan and 7,359, or 85 per cent, definitely stated an intention to qualify. This shows the extent to which free electricity broke down customer skepticism of a power company proposal and smoothed the way for wide acceptance of the lower rate offer. Many unsolicited letters of praise and thanks have come to the company from its customers.

Dealer relations in the San Joaquin territory have been excellent for years as a result of Mr. Courtright's "through the dealer" plan, and it was dealer co-operation that made "free electricity" such a success. In the beginning considerable time and energy were spent in educating the dealers so that they could answer intelligently any questions regarding the plan. The regular dealer display service maintained by the Valley Electrical Supply Company was enlarged, special window display material designed and upward of 300 dealers' windows were trimmed.

In advertising, too, the dealers did their part, and in the larger cities special electrical sections were run once a week during the ten weeks of the campaign. These sections were as large as eight pages in Fresno, seldom less than one page in the smallest towns. The total volume of advertising reached 60,377 inches, or more than 377 eight-column newspaper pages. The dealers, selling appliances of every character and representing every section of the territory, naturally took the greater part of the space, using 33,742 inches. The power company, having no merchandise to sell, used 26,635 inches devoted to explaining the plan and to co-operation with the dealers. The news value of the plan was such that 8,536 inches of excellent news publicity was printed by the 60-odd newspapers in the territory.

The dealers sponsored two electrical expositions, co-operated in fifteen cooking schools and were quick to take advantage of an eleven weeks' tour of the company's all-electric kitchen coach. And, best of all, they sold. Refrigerator sales records were broken. Appliances moved in a continuous stream from jobber to dealer to home. Dealer organizations in the territory received national awards for the best all-around performance in sales of refrigerators, ranges, dishwashers and similar equipment.

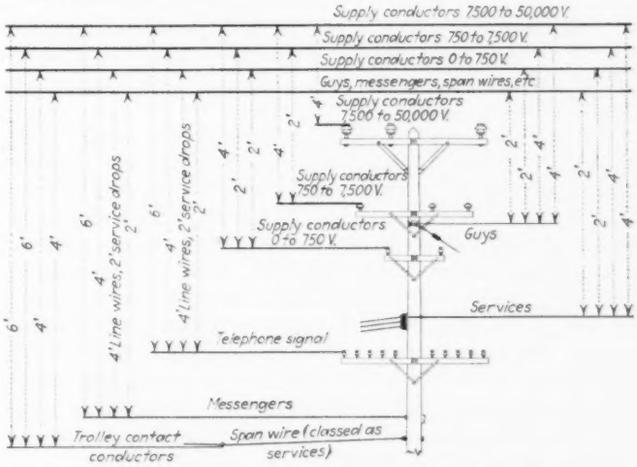
"Dealers not only have been favorable to the offer," says Mr. Courtright, "but report that many customers have praised the San Joaquin for making the offer and for explaining it so that customers understood it. This last is gratifying, because the population in our territory includes a great number of foreigners of different nationalities, many of whom speak and read little or no English. Moreover, the offer was quasi-technical in nature, making it even more difficult to interpret to these foreign groups."

Mr. Wishon estimates the cost of the "free electricity" promotion at less than one dollar per customer who took advantage of it and about 2 mills per kilowatt-hour of free or half-price electricity. "We could estimate rather definitely the cost of the advertising, display and commercial work," he says, "but increment power costs were more difficult to estimate since we had no way of knowing to what extent customers would utilize their privileges and since there were uncertainties as to the amount of hydro power available. Actual costs, however, came well within the budget allowance:

	Budget	Actual Cost
Increment energy costs for "free electricity" and "special use"	$33,450	$27,729
New-business expense for additional advertising, display, etc.	15,663	16,432
Commercial expense for notices, postage, extra help, rate charts, etc.	9,635	6,675
Additions to capital for light-testing equipment, truck banner holders, etc.	1,258	1,704
Total costs	$60,006	$52,540

"This cost is amply justified by even the immediate results, without giving any weight to the continued increased use which is sure to follow the breaking of the consumer economy habit and the purchase of new equipment."

Minimum Clearances at Crossings Up to 50 Kv.


Supply conductors 7500 to 50,000 V.
Supply conductors 750 to 7500 V.
Supply conductors 0 to 750 V.
Guys, messengers, span wires, etc.
Supply conductors 7500 to 50,000 V.
Supply conductors 750 to 7500 V.
Supply conductors 0 to 750 V.
Guys
Services
Telephone signal
Messengers
Trolley contact conductors
Span wire (classed as services)
4' Line wires, 2' service drops
4' Line wires, 2' service drops

The accompanying West Penn Power Company's instruction sheet gives in condensed form information generally covered by many pages of specification. A good sketch is worth volumes of specifications in the field.

Speedier Switching Isolates Faults on 110-Kv. System

Results of a Two Years Experience in Faster Operation of Control Equipment on an Eastern Power System

OUR two years operating experience with faster switching has been most gratifying. Relays have operated in the expected time and oil switches have cleared the faults slightly faster than 8 cycles and with no show of distress. Although the system has encountered faults under conditions conducive to instability no tendency toward lack of synchronism has yet been approached. These are the results that attended progressive changes as the company during 1931 began extending its 110-kv. system preparatory to connecting with the New York Edison Company via a 132-kv. connection. System studies indicated that faults on certain 110-kv. circuits must be cleared in 0.3 second (18 cycles) in order to maintain stability. Certain other 110-kv. circuits could be cleared more slowly, but the existing slow speed equipment was still inadequate.

Faster operation in substation switches

Wherever possible the oil switches were revamped from 18-cycle operation to 8 cycle by mechanical changes and adding oil-blast equipment. Many new oil switches were purchased, all of which were 8-cycle oil blast, some with 1,500,000 kva. and others 2,500,000 kva. rupturing capacity.

Little, of course, could be gained by addition of high-speed oil switches without changing the relay protection. The old relaying consisted mainly of induction type overcurrent relays, with differential (balanced) power and differential ground protection added for circuits operating in parallel.

A more or less standard set-up was used for the new relay protection. Overcurrent, distance-directional and ground-directional relays were installed on single circuits. Differential current and differential ground relays were added to the single-circuit protection when two circuits were operated in parallel. At some stations where parallel circuits were tapped and bussed the percentage unbalance was insufficient to operate differential-current relays. High-speed power directional and plunger type overcurrent relays were then used in the balanced circuit. High-speed plunger type overcurrent relays to reach over a considerable portion of the circuit were employed advantageously in some cases.

When the 132-kv. circuits were placed in service the relay protection consisted of distance directional, ground directional and differential ground relays. Further studies, however, indicated that difficulty might be encountered during swings and out-of-step conditions. The relaying was changed to power directional and ground directional controlled by carrier current. Ground-directional relays, not under carrier-current control, were used as back-up protection.

Lightning proof objective for transmission

The transmission lines of the system are nearly all of double-circuit steel-tower type construction with vertical arrangement of conductors. The later type 110-kv. and the 132-kv. circuits approach a "lightning-proof" design with added insulation and protective equipment. The accompanying table shows the circuit mileage for the different types of construction, with a brief description of circuit characteristics.

Half of disturbances involve only one circuit

During 1932 and 1933 there were 79 cases of trouble on 110-kv. circuits, classified as follows:

Nature of Fault	Number	Per Cent
Single phase to ground	42	53.2
Two phase to ground	15	19.0
Three phase	10	12.6
Phase to phase in span	3	3.8
Miscellaneous	9	11.4
Total	79	100
Failed to hold when closed on test	11	
Total disturbances due to trouble on 110-kv. system	90	

There were two cases of trouble on the 132-kv. circuits. One case was a single-circuit fault which occurred during a sleet storm. The second case occurred during an electrical storm and was a double-circuit fault as indicated by the relay and oil switch operation. The actual cause of these operations could not be found by patrols. The relays controlled by carrier current were in operation for the second case of trouble. Both cases were cleared correctly.

The eleven disturbances caused by failure to hold in on test were due to mechanical failure of circuits and equipment failure at substations.

Out of the 79 cases of trouble, 40 were on 110-kv. steel tower double circuits. Exactly 50 per cent of these involved only one circuit. There was only one case where a single-circuit fault carried into the other circuit as indicated by an oscillograph. This would have been prevented if there had been high-speed switching at the opposite end of these circuits.

Every system operator is haunted by the fear of instability and his responsibility for clearing faults promptly with no incorrect operations. Through quicker breaker action, more thorough relaying and lightning-proof line, the service record has been materially improved. This experience is now made available to other companies.

By WAYNE M. EDSON

REDMOND E. WALSH

Power Control Department, New York Power & Light Corporation, Albany

There were 176 automatic oil switch operations required to clear the above disturbances. These operations can be divided into the following groups:

	Number	Per Cent
Correct	165	93.7
Incorrect	11	6.3
Failed to operate	0	0.0
Total	176	100

Of the eleven incorrect operations, seven were due to differential ground relay operation caused by mutual interference of two tower lines on the same right-of-way. Three other incorrect operations were due to mechanical failure of ground-directional relays caused by excess torque.

The new type relays and greatly improved target mechanisms resulted in an accurate record of relays involved in clearing faults. The following table shows the percentage of oil switch operations initiated by the different types of relays:

Type of Protection	Number	Per Cent
Differential current or power	90	51.1
Ground differential	46	26.2
Distance directional	33	18.7
Overcurrent	7	4.0
Total	176	100

The comparatively large percentage of distance directional relay operations, due in part to simultaneous double-circuit faults, indicates the inadequacy of standard induction type overcurrent relays for back-up protection.

As the protection was primarily designed for high-speed operation, the times required to isolate the faults were of particular interest.

Circuits Involved	No. of Oil Switches Necessary to Isolate Fault	Average Time Required
Single circuit	1	0.19 seconds (11.4 cycles)
Single circuit	2	0.15 seconds (9.2 cycles)
Single circuit	3	0.14 seconds (8.3 cycles)
Double circuit	4	0.70 seconds (45.7 cycles)
Double circuit	6	1.66 seconds (100 cycles)

The average time for clearing double-circuit faults was long due to distance directional time setting of 1.5 seconds for faults in the intermediate zone. This time has since been lowered considerably.

Due to inexperience with this type of relay and the fact that the intermediate zone reached into stations with slow-speed equipment, the settings chosen were of a conservative nature.

Automatic oscillograph a great aid in analysis

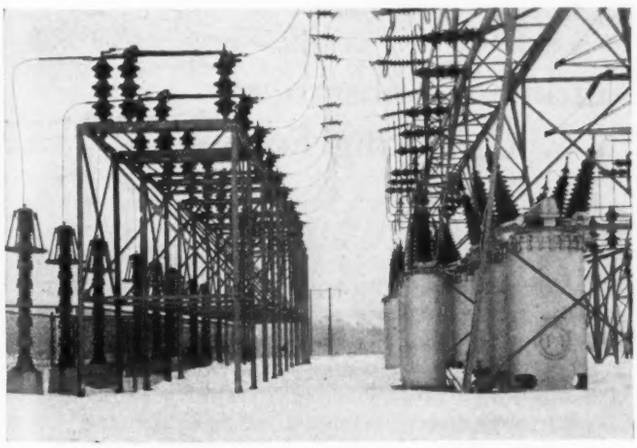
The clearing times were obtained from an automatic oscillograph installed at Rotterdam substation. This oscillograph is a six-element instrument, of which three elements are used to record the three phase-to-phase 110-kv. voltages. The fourth and fifth elements measure the current in phase A of one of the Spier circuits and phase C of one of the Inghams circuits respectively. The sixth element records the current in the neutrals of the two auto-transformers. The operation of the oscillograph is initiated by a starting relay which picks up when there is a total of 40 or more amperes in the auto-transformer bank neutrals.

Out of 90 disturbances on the 110-kv. system, 61 oscillogram records were obtained. For faults at a considerable distance from Rotterdam substation the bank neutral current was not of sufficient magnitude to initiate operation of the oscillograph.

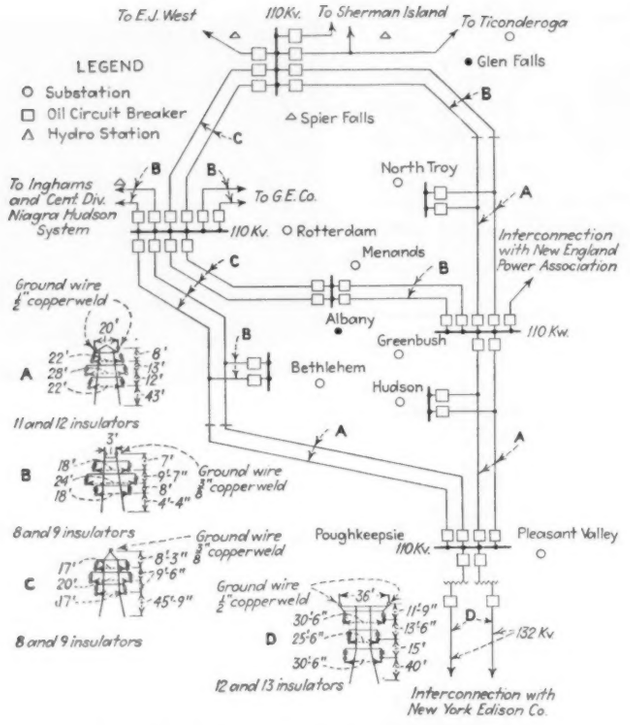
From an analysis of the oscillogram, the following information is obtained: (1) Phases involved, (2) time necessary to isolate fault, (3) sequence of oil switch operation, (4) arcing in oil switch and on circuit, (5) faults carrying into other phases or circuits, (6) magnitude of short-circuit currents, (7) effect on system stability, (8) location of fault.

The magnitude of current for three-phase and phase-to-ground faults on the 110-kv. buses of the system is approximately 6,000 amp. The values for bus faults on the system, obtained from a d.c. calculating board, have been checked with a high degree of accuracy by actual cases recorded by the oscillograph.

Although large values of fault current are encountered,



Typical 110-kv. switch position



New York system escapes instability by high-speed fault clearing

the damage resulting from the arc has been decreased commensurately by the high-speed isolation of the fault. This statement is substantiated by the fact that practically all circuits were returned to service satisfactorily on reclosure after a fault. In many cases difficulty was experienced by patrols in locating trouble due to the small amount of damage. The oscillograms indicate that the period of arcing during the parting of oil switch contacts is less than one cycle for the new and revamped switches as compared with approximately eight cycles on the old slow-speed oil switches.

The oscillograph is used to advantage in locating a fault. The record is obtained as soon as possible after a fault has occurred. The phase involved is noted, and by comparison with former records of trouble on circuit in question the location of fault can be referred to a definite section of the circuit. If the circuit is patrolled and no cause found, more detailed calculations are made to tie the fault down to a limited section of the circuit. On circuits radiating from the Rotterdam bus these calculations have been successful and faults have been located within 10 per cent circuit length of the tower specified. With several oscillographs placed at strategic locations on the system more complete records could be obtained.

Mileage and Characteristics of Circuits

110-Kv. Circuits

Double-circuit steel towers with eleven disk insulators for suspension and twelve disks for dead ends. Protection consisting of two ground wires, arcing shields and armored rods. A.C.S.R. conductors vertically spaced. See (A) in the accompanying illustration		145
Double-circuit steel towers, eight and nine disk insulators, two ground wires, No. 4/0 copper or A.C.S.R. conductors (B). (Excepting approximately 30 miles which carries only one 110-kv. circuit		99
Double-circuit steel towers, eight and nine disk insulators, one ground wire, No. 4/0 copper conductors (C)		97
Single-circuit wood H-frame with grounded steel crossarms and No. 4/0 copper conductors. Ground wire on approximately 50 per cent	(owned)	52
	(not owned)	30

132-Kv. Circuits

Double-circuit steel towers, twelve and thirteen disk insulators. Protection consisting of two ground wires, arcing shields and armored rods. A.C.S.R. conductors (D)	(owned)	29
	(not owned)	11

Gratifying results obtained

From these studies it develops that the newer type of circuit, which was designed particularly to eliminate outage during electrical storms, had only three cases of insulator flashover during more than two years' operation. These flashovers caused little or no damage. The terrain traversed by these circuits is subject to electrical storms of marked severity. This is especially true for the year 1933. As this type circuit comprises two-thirds of the system under discussion, it would seem that these circuits of more liberal design justify the additional expense of construction.

As usual, the conductor farthest from the ground wire had the greatest number of flashovers; 70 per cent of the single-phase insulator flashovers on 110-kv. steel tower circuits were on the bottom conductor and 20 per cent on the middle conductor.

The differential current relays at each end of parallel circuits should operate simultaneously for faults within 90 per cent of the circuit length. However, there is always discussion as to the ratio of cases cleared simultaneously to those cases in which the relays cascaded. During twenty cases of single-circuit trouble on double circuits there was evidence of the relays cascading in only three cases.

The high percentage of correct oil switch and relay operations emphasizes the fact that by careful selection of relay settings, correlated with proper testing and maintenance, the equipment will function as desired under fault conditions. Nevertheless, constant study is required of the actual relay operations and oscillogram records to approach that criterion of relaying—"instantaneous isolation of faults with no incorrect operations."

The relay settings on this particular system were initially of a very conservative nature, but as experience and study warrant, more rapid fault isolation is being obtained.

Automatic Substations Show Operating Economies

By R. J. CORFIELD
Assistant Electrical Engineer
Utah Copper Company, Garfield, Utah

Two automatic substations of 4,000 kw. with automatic reclosing circuit breakers at the Bingham mines of the Utah Copper Company in more than five years have cost in repairs only one cent for every 227 kw.-hr. turned out. Each substation comprises four 1,000-kw., 750-volt d.c., 900-r.p.m. converters. The two are used to supply forty 75-ton locomotives. Practically all mining is done during the day shift, enough ore being mined in that period to

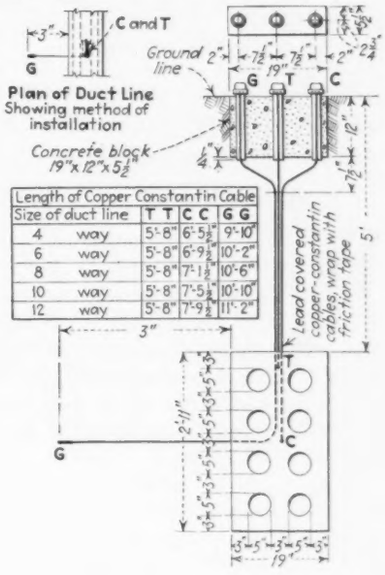
supply the concentrating plants for 24 hours, and therefore service continuity is very essential.

Decision to make the substations automatic followed study of fixed and operating charges and reliability. Only two day-shift operators would be required except in emergency, thus the saving due to direct operation was less in this case than is ordinarily expected in continuously operated stations. Automatic operation also would permit a saving in light load losses and elimination of the cost of a telephone system to cover the entire property, which would be required with manual operation. About 40 per cent of the trolley system is located in the blasting area, and short circuits due to falling trolleys are common and would be taken care of by automatic reclosing circuit breakers, functioning under the short-circuit detector equipment.

The substations have been in operation since 1928 and the operating results, together with the advantages that cannot be capitalized, fully justify the use of automatic stations wherever dependability and economy are of first importance. In a little more than five years a total of 29,004,980 kw.-hr. has been converted with 110 failures of automatic devices. Total cost of equipment repairs has been $1,277.56 for the period, which is a cost per kilowatt-hour of $0.000044.

Thermocouple Standards for Duct Temperature Studies

Cables are loaded on a temperature basis in many instances and very frequently the problem of cable temperature measurement is encountered. The accompanying illustration shows the installation of thermocouples for temperature measurements as used by the Kansas City Power & Light Company.



Length of Copper Constantin Cable					
Size of duct line		T	T	C C	G G
4	way	5'-8"	6'-5½"	9'-10"
6	way	5'-8"	6'-9½"	10'-2"
8	way	5'-8"	7'-1½"	10'-6"
10	way	5'-8"	7'-5½"	10'-10"
12	way	5'-8"	7'-9½"	11'-2"

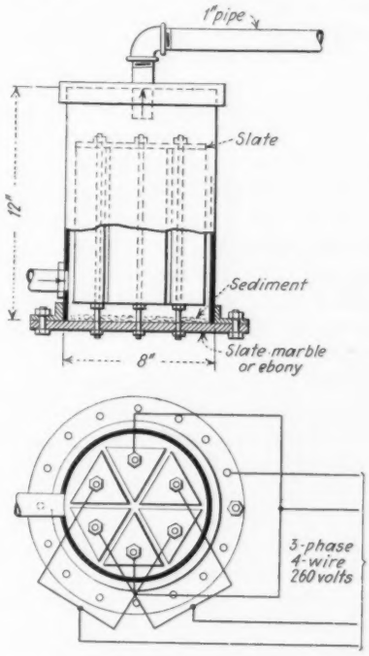
Electrode Elements Used in 3,000-Watt Heaters

By FRED CLAYTON
Nashville, Tenn.

A number of shop-fabricated electric water heaters, 3,000 watts and larger, using water as the heating element, were in operation for about twelve years in the plant of the Gulf Lumber Company, Fullerton, La. Economical both as to first cost and operation, their performance suggests the possibility of their "off-peak" use for heating hot water in place of immersion heaters and for existing steam and hot water heating systems for domestic, hotel or apartment service. Of course, such heating systems themselves are inefficient, but as a heat generator this type of unit is efficient and could well replace fuel-fired units where the surplus power is available during off-peak hours.

For the 3,000-watt heaters we built for company use a section of ordinary 8-in. iron pipe about 12 in. long was employed with a regular 8-in. pipe cap screwed on one end for the top end of the boiler. An 8-in. flange, half screwed on the other end, to which was bolted an insulating plate of 1-in. slate, marble or ebony, served as the bottom. This plate must have strength according to the water pressure and serves as the insulating member to support the electrodes. Long rods $\frac{3}{8}$ x 8 in., threaded the entire length, serve to support the electrodes at a height above the bottom sufficient to allow for sediment.

V-shaped troughs of $\frac{1}{16}$-in. sheets of iron, lead or other suitable metal, six in number, comprise the actual electrodes. These troughs present side surfaces approximately 3 in. wide by 9 in. long and have their ends closed by bending the sides in to lap together and drilled for mounting. The lower ends of these six troughs are mounted on the six $\frac{3}{8}$-in. studs projecting up through the bottom insulating plate. The tops of these troughs are bolted to an insulating plate, thus being firmly held in a circle with the adjacent sides of the electrodes about $\frac{1}{4}$ in. apart. In operation the heated water rises upward between these electrodes to the top insulating space-plate, through which large holes are drilled for circulation to the 1-in. pipe at the top of the boiler or connected to the storage tank.



Water connections to the heater consist of a 1-in. pipe tapped into the 8-in. cap and also the side just above the flange for circulation. Opposite the lower pipe a 1-in. drain valve is tapped into the heater for flushing out the sediment and rust. Trough - shaped electrodes are formed at approximately 60 - deg. angles. The holes in the insulating plate through which the terminal stud rods project are reamed to allow packing to be squeezed under washers with nuts to make a watertight joint, and sheet packing is also used between the flange and insulating bottom plate. Alternate electrodes are connected together and to the same lines of a four-wire, three-phase, 260-volt circuit. Capacity can be varied, however, by changing to a different connection, of which several are possible. Control in most cases was thermostatic, but could be pressure-operated for steam application.

Shop-fabricated water heaters utilize water as the heating element

We Are Climbing Out

By G. F. WITTIG
Statistical Editor *Electrical World*

Measured by electrical energy consumption, the decline started early in 1929 and struck bottom in the summer of 1932. Recovery has been definite and much of the lost ground has been regained. In the industries most affected the rise has been as steep as the preceding decline. Some lines of manufacturing are virtually at the 1929 level. The study is based on ten-year records collected by *Electrical World*.

WHAT are the prospective needs for new electric power equipment in factories? What is the effect of present and prospective industrial conditions on central-station loads? These are two questions now confronting the electrical industry in both the manufacturing and power generating branches. As the intensity of use of existing equipment increases, the need for replacement increases; as the load mounts, central stations need to be prepared to meet it.

For nearly a decade ELECTRICAL WORLD has been compiling monthly returns on energy consumption from representative manufacturers and from power companies, classified by industry groups. The results of this co-operative survey have been regularly published in the form of an index of industrial activity. An eight-year record for a number of these industry groups is shown in the accompanying charts.

Durable goods worst hit

Consider first the group of Fig. 1. They have certain characteristics in common—a rise culminating before the middle of 1929; a decline of excessive severity persisting for more than three years; bottom in August, 1932, down somewhere around 25 per cent of the former peak; subsequent recovery of half the loss; upward gradient as steep as the previous decline. Certain details are readily discernible, such as the moratorium in March, 1933, the prompt resumption of the rise—somewhat overenthusiastic—the moderate setback and the renewed ascent since last winter.

Iron and steel attained a top of 172.2 (using the 1923-25 average as 100) in May, 1929. The bottom, in August, 1932, was 44.0. Three-fourths of the activity at the peak has vanished. The May, 1934, figure is 97.2, considerably more than twice the minimum. Short-range forecasts are hazardous; they are likely to be remembered when the event occurs. It might be pointed out, though, that it seems to be characteristic of this industry to be more active in the first half-year than in the second, but that this feature was absent during the rising year 1928, and that thus far in 1934 the movement has been consistently upward. As to the magnitude of this industry, the latest available electrical statistics are those of the Census of Manufactures for 1929. In that year it purchased nearly 5,000,000,000 kw.-hr. and operated about 3,800,000 hp. of electric motors on purchased energy, plus a somewhat larger capacity on energy generated in private power plants (see accompanying table).

By way of comparison, sales by central stations of energy at wholesale to all kinds of industries during the same year were 44,325,000,000 kw.-hr., according to the Edison Electric Institute. Purchases by the iron and steel industry equaled 11 per cent of that amount.

For the metal-working industry the variations in energy sales were similar to those of iron and steel. The peak, in February, 1929, was 152.7, again on the average month of 1923-25 as 100. The lowest value was 45.0, the latest was 88.5. Thus the decline cut off more than 70 per cent. Recovery has already doubled the minimum figure.

The nearest corresponding Census group is "Machinery, not including transportation equipment." It purchased 2,823,000,000 kw.-hr. in 1929, equivalent to 6.3 per cent of the 44,325,000,000 kw.-hr. previously mentioned. It operated 2,815,433 hp. on purchased energy in addition to 793,463 hp. on privately generated energy.

Most violent of all was the fluctuation in the automotive industry. At its worst the energy used was down to one-fifth of the maximum. By last April half the lost ground had been recovered.

Energy used the yardstick, not goods production

It should be reiterated that the statistics here quoted are strictly electrical. They are based solely on energy consumption as reported by the industries directly to ELECTRICAL WORLD in a continuous survey that, so far as is known, is unique.

Only one adjustment has been made. In those months having more or fewer than 26 working days, excluding Sundays and holidays, the proper ratio has been applied

Motor Horsepower and Purchased Energy

Motor horsepower is classified as to operation on (a) Purchased energy and (b) Energy generated in manufacturers' plants.

(Source, Census of Manufactures, 1929)

Industry Group	Motor Horsepower (a)	Motor Horsepower (b)	Energy Purchased Million Kw.-hr.
Iron and steel	3,792,146	4,106,875	4,986
Metal working(*)	2,815,433	793,463	2,823
Automobile(†)	1,172,751	1,193,327	1,354
Food products	2,831,975	642,530	4,171
Leather products	235,694	119,994	228
Textiles	2,156,673	1,044,623	4,033
Rubber products	572,363	240,921	882
Stone, clay and glass	1,798,757	312,862	2,845
Chemical(‡)	1,841,249	1,157,510	8,094

(*)Machinery, not including transportation equipment.
(†)Motor vehicles, bodies and parts.
(‡)Chemical products combined with petroleum and coke products.

to make the months comparable. This adjustment seems slightly to exaggerate February operations at the expense of March, but it remains the least objectionable method of taking account of the eccentricities of our calendar. The agreement between energy consumption and factory output has been discussed for specific industries in several articles that have appeared in ELECTRICAL WORLD: Automobiles, February 14, 1931, page 341; rubber, August 29, 1931, page 390; textiles, July 15, 1933, page 80.

Consumer goods far steadier

Fig. 2 presents an entirely different group. Food products, textiles and leather products are "consumer" goods. They are far more stable in operation than the group in Fig. 1.

The first of these has for six years been swinging along on a regularly repeated and almost unvarying annual cycle. Even in 1932 the energy consumption was only moderately below that of other years. Depression, in the sense experienced, for example, by the automobile industry, simply did not happen and 1934 promises to be similar to other years.

In textiles, there is usually a pronounced midsummer sag; it was completely absent, however, in 1931, and then abnormally severe in 1932. Despite the decline last spring, operations are now nearly 90 per cent above the minimum.

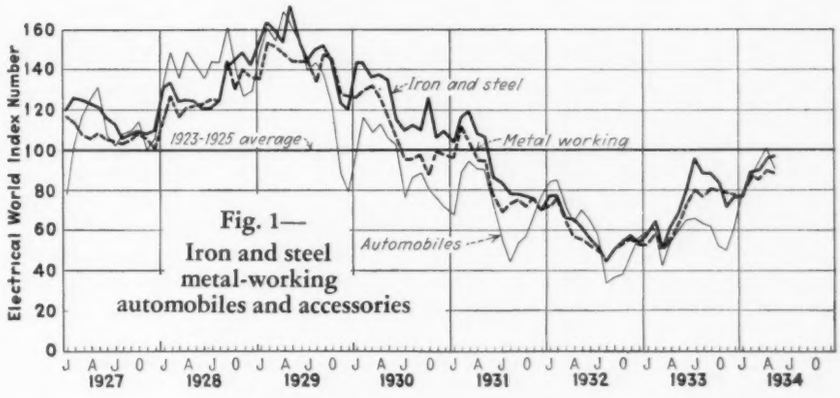


Fig. 1— Iron and steel metal-working automobiles and accessories

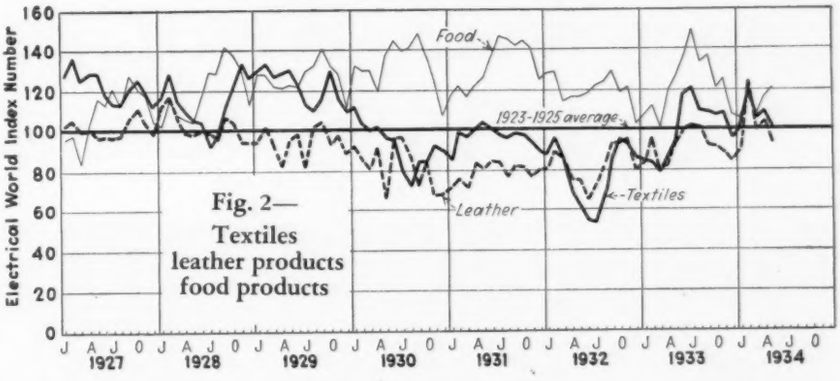


Fig. 2— Textiles leather products food products

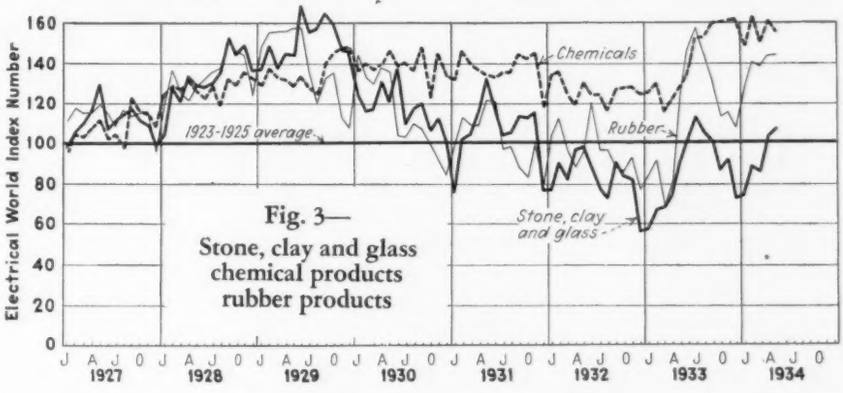
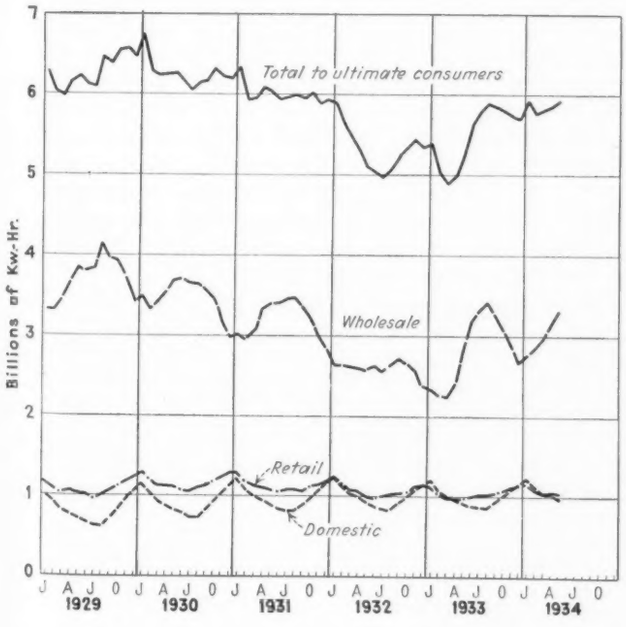


Fig. 3— Stone, clay and glass chemical products rubber products

Fig. 4—Energy sales to ultimate consumers

Total and major classes
Based on statistics published by
Edison Electric Institute



As energy users, the food and textile industries are nearly equal, each using three times as much as the automobile industry.

The third of this group, leather products, when at its worst was only 44 per cent below the 1928 maximum, and lately has actually been above the 1929 average in its consumption of electrical energy.

Rubber, chemicals and stone

A miscellaneous group is represented in Fig. 3. So long as automobiles remain on the road tires wear out and have to be replaced. Springtime sales of new cars accentuate the demand. In 1933 a rush to stock up in anticipation of code requirements contributed to cause a doubling of operations within a period of four months. The resulting oversupply was followed by a decline, then vigorously renewed activity. The electrical requirements are now near the 1929 level.

In the stone, clay and glass group stagnation in construction activity is reflected in a minimum only one-third as great as the maximum. While the subsequent improvement is apparent, the fact should not be over-

looked that winter regularly brings a recession in this group of industries.

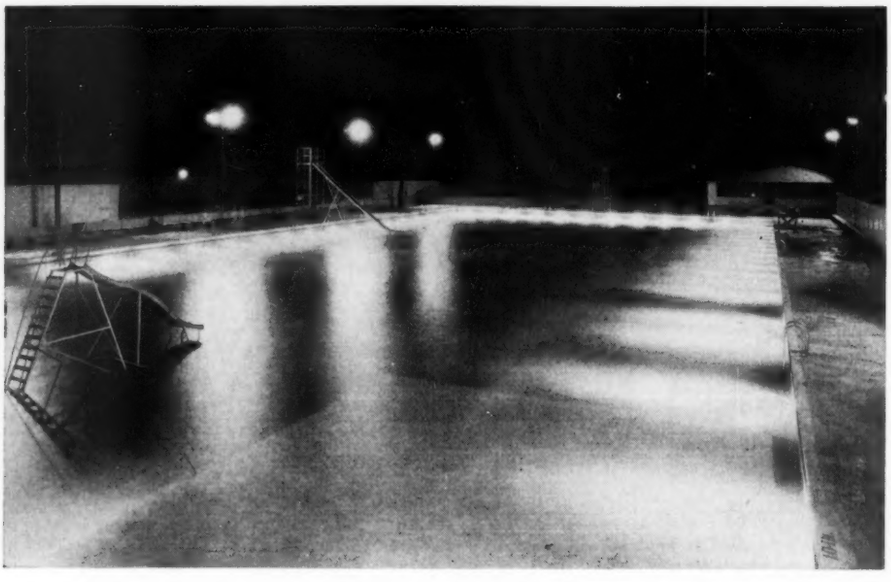
Finally, the composite activities of the chemical industries, including oil refining, show remarkable stability and a present level higher than in 1929.

The composite output

Many of the larger individual establishments in these and other industry groups have their own sources of power. Many, however, buy central-station energy. How these loads, together with domestic, retail commercial and sundry minor uses, combine to make up the country's aggregate central-station load curve appears in Fig. 4, plotted directly from the monthly statistics of the Edison Electric Institute and its predecessor, the National Electric Light Association. No adjustment has been made for differences in the length of the months.

Even in these abnormal years the characteristic autumn rise is evident. The output is now close to that of 1929, but with a rising trend that is unusual during the first half-year. The evidence points to a winter maximum approximating that of 1929. Those systems that are overspeeding the national average should establish all-time peaks within the next six months.

Under-Water Pool Lighting Brings Several Innovations



Added safety and appeal for night bathers are given this Clifton, N. J., pool by the use of under-water lighting. The floodlights illuminate the surroundings and aid in building up the illumination level at the center of the pool on which they are focussed

By

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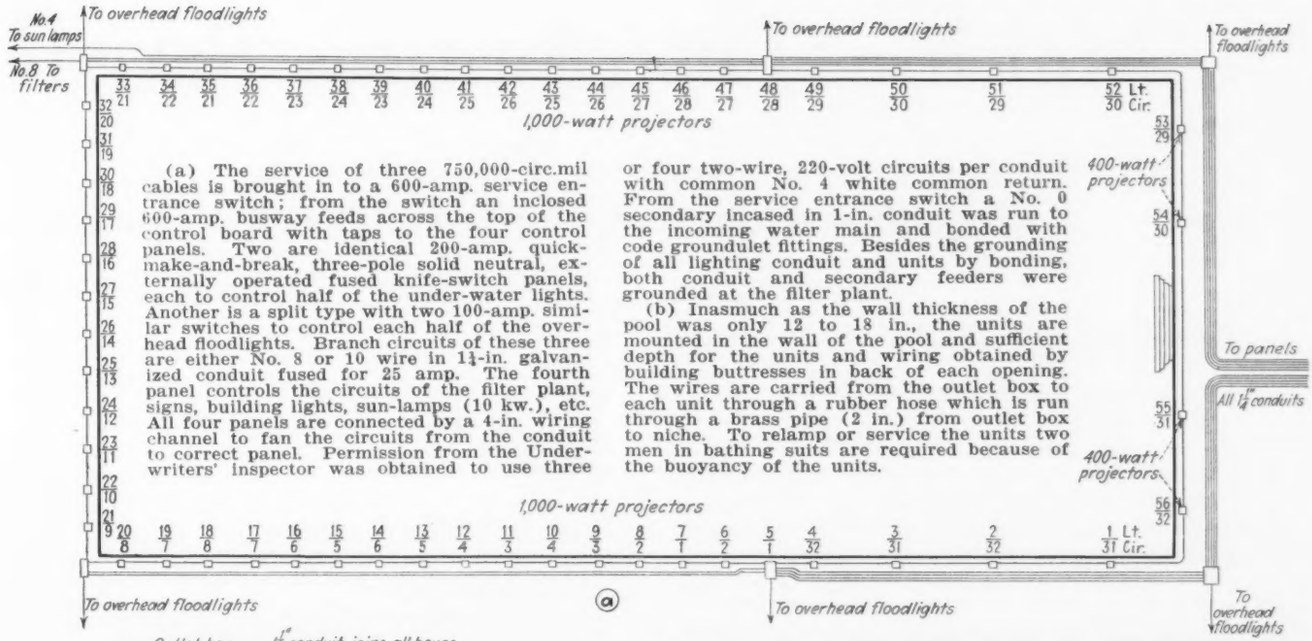
MORE than 50 kw. of under-water lighting, consisting primarily of 1,000-watt units, has been employed to light Rentschler's Clifton Swimming Pool at Clifton, N. J., to attract night bathers. It is believed to be one of the largest outdoor installations of its kind. Added safety and greater appeal are counted upon greatly to increase the popularity of night bathing and water sports and to more than pay for the added cost of installation.

The total under-water lighting load is 51.2 kw. and consists of 48 1,000-watt, water-tight projectors and eight 400-watt similar units, placed in cubical niches in the concrete walls of the pool. Lights are 10 ft. apart except at the shallow end, where they are spaced 20 ft. The under-water lights are supplemented with overhead lighting consisting of ten 1,000-watt open reflectors spaced 60 ft. on centers and mounted 27 ft. high. The electrical service provides for 100 kw., allowing ample reserve for future needs.

Over-all dimensions of the pool are 100x225 ft. and the depth varies from 2 to 9 ft. The reinforced concrete walls of the pool are from 12 to 18 in. thick. Water is taken from the city main and sent through a filtering and chlorinating plant, which furnishes a complete water turnover every seven hours. The pool has a capacity of about 900,000 gal. of water and with plant going fourteen hours a day can accommodate 10,000 bathers per day and maintain clear water.

Some experience with under-water units

Many problems arise in under-water lighting, both mechanical and electrical, which are not met with in dry installations. Light penetration in water compared with air must be contended with. Water clearness has also a considerable effect on the penetration. It was found that with the 1,000-watt submersible projectors shown in one of the sketches, which had a 12 deg. beam spread and beam-lumen of approximately 42 per cent based on the bare lamp output, there was a penetration visible to the eye of 30 to 35 ft. This left a 30 to 40 ft. dark


No.4 To sun lamps
No.8 To filters
To overhead floodlights
To overhead floodlights
To overhead floodlights
1,000-watt projectors
400-watt projectors
To panels
All 1¼" conduits
400-watt projectors
1,000-watt projectors
To overhead floodlights
To overhead floodlights
To overhead floodlights
(a) The service of three 750,000-circ.mil cables is brought in to a 600-amp. service entrance switch; from the switch an inclosed 600-amp. busway feeds across the top of the control board with taps to the four control panels. Two are identical 200-amp. quick-make-and-break, three-pole solid neutral, externally operated fused knife-switch panels, each to control half of the under-water lights. Another is a split type with two 100-amp. similar switches to control each half of the overhead floodlights. Branch circuits of these three are either No. 8 or 10 wire in 1¼-in. galvanized conduit fused for 25 amp. The fourth panel controls the circuits of the filter plant, signs, building lights, sun-lamps (10 kw.), etc. All four panels are connected by a 4-in. wiring channel to fan the circuits from the conduit to correct panel. Permission from the Underwriters' inspector was obtained to use three or four two-wire, 220-volt circuits per conduit with common No. 4 white common return. From the service entrance switch a No. 0 secondary incased in 1-in. conduit was run to the incoming water main and bonded with code groundulet fittings. Besides the grounding of all lighting conduit and units by bonding, both conduit and secondary feeders were grounded at the filter plant.
(b) Inasmuch as the wall thickness of the pool was only 12 to 18 in., the units are mounted in the wall of the pool and sufficient depth for the units and wiring obtained by building buttresses in back of each opening. The wires are carried from the outlet box to each unit through a rubber hose which is run through a brass pipe (2 in.) from outlet box to niche. To relamp or service the units two men in bathing suits are required because of the buoyancy of the units.
Outlet box
¼" conduit, joins all boxes
Concrete wall
Water level
Earth
2 ft.
1 ft.
Bronze guard plate
2 ft.
Watertight projector
Rubber hose, box to projector contains lighting cable and ground wires
Concrete buttress built around each opening
(a)
(b)

Outlet boxes and distribution panels are connected by conduit; lighting units by rubber hose to outlet boxes

spot in the center of the pool which was improved by focussing the floodlights in the center. The real solution would be a central island with the necessary additional under-water projectors.

All materials selected must be impervious to water and its chemicals, such as chlorine and ammonia. From this standpoint aluminum projectors had to be replaced by bronze cases because the cast aluminum showed chemical corrosion. To permit servicing of the projectors without lowering the water about 10 ft. of excess cable is provided for each unit and coiled behind the projector in the cubicle. The units can be detached from their base by removing a center bolt and brought to the pool edge for repairs or bulb replacements. The necessity of draining under-water projectors of water which would collect by "breather action" is obviated by running feed and ground wires from the projector outlet box through a rubber hose which keeps projectors at atmospheric pressure so no water can be sucked in by vacuum. Cloudy lenses and resultant damage are thus avoided.

The main lighting service of three 750,000-circ.mil cables permits a maximum load of 600 amp. at 220 volts. Branch circuits were calculated for a maximum of 3 volts drop. The longest run on the layout shown is 275 ft. The supply is such that one-half of the lights can be put on if desired. For electrical safety the whole conduit system is bonded into a unit grounded at eight points. Each light under water is positively grounded to bond bushings, which are a part of the conduit system.

Economically to supply uniform under-water lighting to an outdoor swimming pool involves provision for safety to bathers, ready maintenance of units and the relatively poor penetration of light under water. In this installation supplementary floodlights, safety bonding, provision for "breathing" and new schemes of mounting were found to give a successful solution to a problem confronting other illumination and sales engineers.

Air Conditioner Paid for Out of Tomato Savings

By preventing the usual loss from drying out under atmospheric conditions a type AC-1 G.E. air conditioner installed in a tomato-ripening room saved its cost on a single carload of the fruit. The unit was installed in the ripening room of the Morris Fruit & Produce Company, Minneapolis, Minn. The room holds two carloads of tomatoes, and before the installation of air conditioning as high as 20 per cent of each carload spoiled from loss of moisture. Periodic sprinkling had failed because only the top layers received the proper amount of moisture.

At present the room is maintained at a fairly high temperature and the humidity held at approximately 70 per cent by the conditioning unit to promote ripening. All tomatoes are prevented from drying out and actually tend to regain their natural moisture content. The fruit remains firm and solid and commands better prices.

Making Distribution Satisfy

Relentless Inspection, Instructive Records, Intelligent Customer Psychology Assure

By FRANK E. SANFORD*

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TO REVIEW a number of the operating and service aspects of electric distribution, to study in detail the effectiveness of several maintenance policies and to present a possible perspective viewpoint of distribution as a part of the electric system is the purpose of this paper.

In a regular tabulation of troubles, complaints, changes made and results obtained certain principles may serve as a guide or "yardstick." Briefly summarized, they are: (1) Measure continuity of service; (2) measure voltage control.

Just as the annual accounting of profit and loss and the inventory are invaluable to the business executive in outlining his policies and program for the next year, these annual summaries of operation serve the distribution superintendent and engineer in maintenance and construction programs. If the tabulations are made monthly and then summarized at the end of the year they are of constant value, not only to those to whom they are submitted, but to those charged with the individual jobs as well. In the paragraphs and charts which follow a review of such a report is given, based largely on 1933 operation.

The complete report covers a central division and three smaller divisions of a system of 140 feeders serving 187,000 residential customers and the portion of 28,000 commercial customers outside the underground network area. Industrial service to 5,700 customers is divided between the overhead distribution, sub-transmission and network systems. The load density on urban feeders varies from 1,000 to 10,000 kva. and on the suburban feeders from 150 to 2,500 kva. total connected per square mile. Street lighting is served mainly by separate series circuits from the substations, with some constant current transformers supplied from the 4-kw. feeders.

Overhead distribution lines are operated three-phase, four-wire 2,400/4,150 Y volts, with all single-phase transformers (except some rural) connected phase to neutral. The central transmission system is at the generating voltage of 13,200. Tie lines between substations and sub-transmission feeders also serve the larger power loads and in addition a number of outlying distribution substations. For distribution centers in outlying territory supply to the substations is at 33,000 volts. There are two power plants in the area, West End station in Cincinnati and Columbia station outside the city, with 66,000-volt transmission into the opposite side of the main load area.

Interruptions of service on kva.-hr. basis

Transformer failure records are commonly compared on a percentage basis. Blown primary fuses at transformers or at branch lines from the main feeder may be compared in the same way. Wide differences of load density and transformer size and spacing may confuse the comparison. Sometimes transformer and other troubles are also put on a number per 100 miles of line basis. For any one system a year-by-year comparison on this basis is sufficient, but it is not practical for comparing different load density sections of one system or of different systems. For example, a comparison between two companies showed 9.7 transformer coil failures per 100 miles of line for one and 0.063 for the other. On a percentage basis, however, the first company had 0.62 per cent and the second 0.69 per cent.

A formula which has been used and which gives a very good measure of service is "availability," the percentage of connected capacity to service that is available to the customer. Expressed in another way, it is the kva.-hrs. total of outages compared to kva.-hrs. available if no outages had occurred. Since the unit sold is the kw.-hr., the logic of this basis is obvious. Some practical disadvantages are apparent also, but when the per cent of

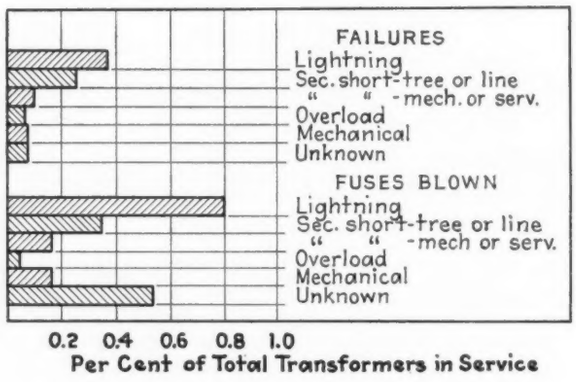


Fig. 1—Lightning biggest cause of blown fuses and transformer failures

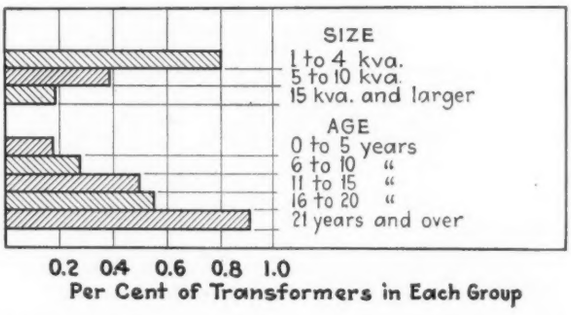


Fig. 2—Smallest and oldest transformers most vulnerable to lightning

Abstract of paper awarded one of James H. McGraw Edison Electric Institute prizes for engineering at recent E.E.I. convention.

Customer and Management

Analysis, Attention to Little Things, Understanding of Service Quality and Continuity

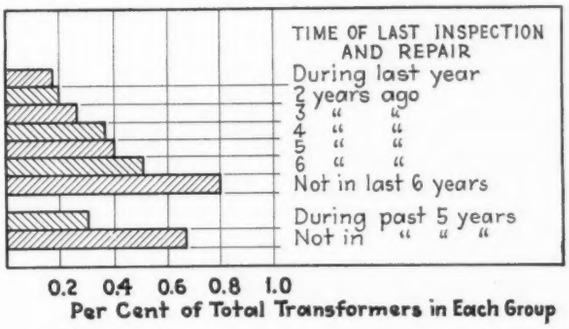

TIME OF LAST INSPECTION AND REPAIR
During last year
2 years ago
3 " "
4 " "
5 " "
6 " "
Not in last 6 years
During past 5 years
Not in " " "
0.2 0.4 0.6 0.8 1.0
Per Cent of Total Transformers in Each Group

Fig. 3—Frequent inspection and repairing cuts transformer failures

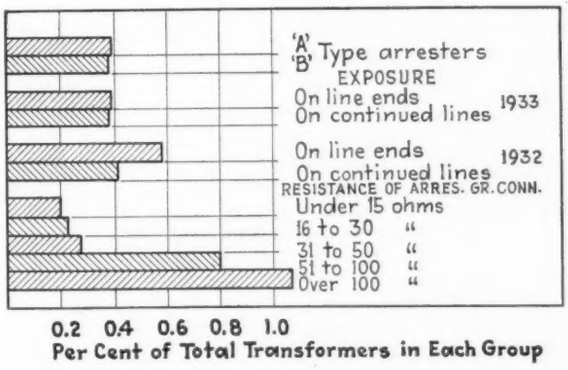


Fig. 4—Low ground resistance averts impulse failure

units in trouble, feeder outages, and details, are used in conjunction with such a summary figure, the operation perspective is fairly complete.

Availability on the urban section of the distribution system for 1933 was 99.99787 per cent, or, in other words, there were 2.13 kva.-hrs. outage per 100,000 kva.-hrs. operation. On the suburban section the outage was 4.67 and on the rural 20.64 per 100,000 kva.-hrs. These figures are detailed by location of troubles, in Table I.

A summary and classification of distribution line troubles and transformer troubles is given in Tables II and III. This is for the 64 urban and suburban feeders. For the past two years 92 per cent of the feeder outages have been for less than one minute; that is, the trouble was cleared on reclosure of the feeder switch. The most outstanding improvement in feeder outages has been from reduction of fuses failing to clear, or not clearing ahead of the relay operation.

It is doubtful that much further reduction can be made in feeder outages due to distribution line troubles, at least on urban and suburban feeders. Fusing of branch lines, or taps from the main feeder, as it is done on this system, helps to reduce the number of feeder outages. The balance must be between a possibility of long-time outages to a part of the customers and a larger number of short-time outages to all the customers on a feeder. Without these sectionalizing points an entire feeder might be held out of service while many miles of line are patrolled to locate a wire down, or other trouble.

The biggest field for improvement in service is by reduction of trouble at transformer installations. These interruptions, although each affects a small percentage of the customers on a feeder, are almost always for much longer periods of time. Careful inspection is often necessary to differentiate between lightning and secondary short circuits as cause of trouble during a storm.

It is most convenient to study the details of these causes and conditions when in graphic form. The accompanying charts show several such analyses much more clearly than would the original figures on which they are based. In these charts the units in trouble are shown as a percentage of the number or estimated number of units with similar conditions.

Grounds Interconnected—Before the lightning season of 1933 eight feeders were selected which had higher than average percentages of transformer troubles in 1932, for trial of the interconnection of grounding. These feeders are mainly in the lower load density areas of the suburban group. Lightning arrester grounds and secondary neutral grounds were tied together only where inspection showed there were two or more water pipe grounds on customer's premises, on the secondary.

With this conservative policy interconnection was made at a total of 708 installations. There were no failures caused by lightning in this group. At the same time this work was done an inspection of the installation was made and fusing and other conditions were checked and corrected. While this limited experience is not sufficient for a definite conclusion, it does check with the records of other companies. It is planned to continue this more extensively in 1934.

During the past six years a regular schedule has been followed for inspection and repair of transformers in service. Oil, leads, bushings, arresters, fuses and ground connections are checked, and repaired where found necessary. The transformer case is cleaned and painted. In addition it is the policy to return to a central repair shop all transformers removed from service due to rebuilding, rearrangements or other reasons. After complete disassembly and cleaning they are put in first-class condition and given

In this prize paper it is shown convincingly that painstaking analysis of the details of current operations is the most promising path to lower distribution cost of better service, more load and happy users. Intuition will never ferret out all the weak spots—factual records will. The rest lies in sensible, executively-supported action on the facts.

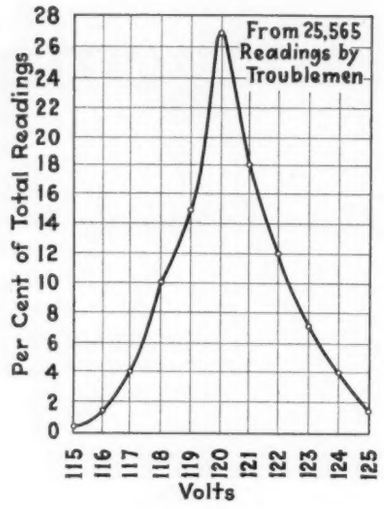


Fig. 5—Seventy per cent of service-entrance voltages found between 118 and 122 volts

the same tests as new transformers, before again being placed in stock (see Fig. 3).

An even greater reduction is made in the blowing of fuses due to insulator and lead troubles and internal flashover due to low oil level. A three-year average indicates that this inspection and repair policy reduces troubles between 50 and 60 per cent, comparing transformers inspected during the previous five-year period to those not inspected in this period.

Grounding Resistance—The data shown in Fig. 4 check fairly closely with theoretical consideration and other tests on satisfactory grounding conditions. A value below 50 ohms for a single driven rod has been found readily obtainable in most cases in this locality. As part of the inspection and repair in service routine 1,700 grounds were checked in 1933. The installations had been made over a period of two to ten years or more previous. Eighteen per cent of the arrester grounds were above 50 ohms as found. This was reduced to less than 4 per cent. The average resistance on the repaired feeders is now about 25 ohms.

Application of Primary Fusing—In 1931, after a study and extensive tests on primary fuses and fusing application, a new basis was adopted using newly developed bimetallic links. This was reviewed in a paper presented by the writer at an A.I.E.E. district meeting at Kansas City, October 22-24, 1931. Companion papers on principles and design of expulsion type fuses were presented by representatives of two manufacturing companies. The new fusing was based on short circuit rather than overload current and co-ordination of relay settings with fuse time-current characteristics was provided.

Relaying open of the feeder switch due to too slow blowing of the fuse at some values of short-circuit current, or due to shattering of the box and failure to clear, has been reduced as the new fusing has gradually been applied throughout the system. On the entire 140 feeders there were 24 feeder outages from this cause in 1930, sixteen in 1931, eight in 1932 and none in 1933.

At the same time that this reduction in feeder outages has been effected local outages due to transformer fuses blowing have also been reduced. Plug-type cut-outs were in use on a majority of the older installations, and experience since the decision to replace them has confirmed the practical value of the new basis. The 1933 record shows 4 per cent of the plug-type fuses in service blown during the year, compared to 1.7 per cent of the smaller type expulsion fuses. In 1932 2.3 per cent of the plug-type and 1.1 per cent of the expulsion fuses in service were blown. Many needless fuse blowings and resulting outages are thus eliminated.

Voltage control a major aspect of analysis

All of the 64 feeders in the urban and suburban divisions have single-phase induction-type voltage regulators, compensated for phase area control. The regulator settings and operations are checked semi-annually by voltage charts taken at test points in each phase area. This central division and one other division are covered in about two years by a night-reading crew checking transformer loading and voltage and secondary end voltages on all single-phase transformers. A summary of this routine check for the central division is given in Table IV. In addition to this work the same crew checks current in the constant current street-lighting transformers on the same feeders and makes special tests as required.

Table I—Kva.-Hrs. Outages in Parts of 100,000 Kva.-Hrs. in Operation

	Distribution Trouble				Transmission or Substation Trouble	Total
	Feeder Outage	Branch Line Fuse	Transf. Fuse or Failure	Total		
32 Urban feeders	0.71	0.80	0.62	2.13	0	2.13
32 Suburban feeders	0.68	1.14	1.39	3.21	1.46	4.67
14 Rural feeders	2.80	2.40	0.74	5.94	14.70	20.64

Table II—Feeder Outages—Urban and Suburban

Feeder relayed out during storm	9	
Wire burned down by lightning	5	
Failure of lightning arrester	3	
Lineman caused short circuit	1	
Wire down by causes beyond control	8	
Failure of pothead	1	
Failure of station equipment	9	
Outage of transmission circuit supply	34	
Total feeder outages	70	
Outages due to distribution line trouble	27	
Per 100 miles		4.7
Fuses blown on overhead branch lines	56	
Per cent (598 locations—971 total fuses)		5.8
Total overhead troubles per 100 miles of line		14.8

Table III—Transformer Trouble—Urban and Suburban

	Fuses Blown	Failures
Fuses blown	146	.....
Transformers failed total (see note)	.....	65
Percentage (6,810 transformers)	2.13	0.94
Percentage of kva. (137,000 kva. total)	1.81	0.66
Transformer coil failures	.....	53
Percentage coil failures	.....	0.76
Cause:		
Lightning	55	23
Short circuit due to line or tree conditions	24	18
Short circuit mechanical or service	12	7
Overload	5	5
Mechanical	14	6
Unknown	36	6

Damaged Part—Transformer Failed

	Per Cent		Per Cent
High-voltage coil only	10.9	High-voltage bushing	2.0
Low-voltage coil only	11.1	Low-voltage bushing	2.9
Both coils	49.5	Terminal or leads	13.6

Note—Transformer failure counted as all cases where transformer is removed from service following repeated blowing of primary fuses. Fuse blown—does not include fuses blown by transformer failure.

A further check of voltage conditions is obtained by readings at the customers' service entrances. These readings are taken by the troublemen who replace blown service fuses. High and low readings are checked by the voltage complaint inspector. All of these data—charts and readings—are used by the engineers on voltage control to lead to correction of transformer and wire capacity and arrangements. Two measures of the effectiveness of the voltage control operations are used: First, average system voltage readings; second, voltage complaints received. The average of the 2,623 transformer secondary readings was 121.1 volts and of 3,169 secondary end readings 119.5 volts. The average of 25,565 entrance switch readings detailed in Fig. 5 was 120.2 volts. Seventy per cent of the total number of readings were between 118 and 122 volts. All of the reading data are kept in detail by feeders, together with the justified voltage complaints on each feeder.

Transformers for residential service are loaded on the

Table IV—Load and Voltage Readings

	Number	Per Cent
Feeders covered by test (central division)	40	
Transformer load tests	2,623	
Found overloaded	112	4
Found underloaded	756	29
Found O. K.	1,755	67
Secondaries tested	1,742	
Found O.K.	1,412	81
Rearrangements required	330	19
Rearrangements ordered:		
Spans No. 6 changed to No. 2	810	
Spans No. 2 changed to No. 2/0	16	
New transformer installations	149	
Transformers relocated	55	
Transformers relocated and size changed	73	
Transformers changed at same location	155	
Transformers removed from service	16	
Primary rearrangements ordered	80	
Primary phase areas changed	15	
Feeder areas changed due to load and voltage conditions	13	

Table V—Voltage Complaints

	Number		Per Cent	
Voltage complaints checked (central division)	353			
Found justified	172		49	
Found voltage normal	181		51	
Reported high	157		45	
Found high		44		25
Reported low	72		20	
Found low		43		25
Reported fluctuating	124		35	
Found fluctuating		85		50

Summary of Causes of Justified Complaints:

Overloaded primary	9	Wiring or appliances	9
Overloaded transformer	7	Regulator adjustment	21
Overloaded secondary	56	Transformer trouble	2
Overloaded service or premise	12	Wrong primary phase	10
Loose connections	27	Miscellaneous	14
Load unbalanced	5		
		Total	172

Table VI—Radio Interference

	Number	Per Cent
Radio complaints checked (central division)	309	
Electric service caused	64	21
Customer's appliances	45	13
Radio set trouble	71	23
Other utilities caused	15	5
Unfounded or disappeared	114	36

Causes of Electric Service Interference:

Primary plug-type fuses	8	Arc lamp or circuit	7
Primary wood box fuses	2	Tree grounds	15
Primary porcelain box fuses	5	High-voltage line discharge	9
Lightning arresters or conn	4	Voltage fluctuation	4
Secondary trouble	6	Other causes	t
			—4
		Total	64

basis of carrying 160 per cent of their rated capacity at the time of peak load. Loading curves have been plotted to give the transformer size required for any ampere reading during the year. These curves are based on average residential demand curves, temperature rise and ambient temperature for the type loading and conditions of this locality. Two measures of the effectiveness of this method and the periodic check are, first, the very small number of transformers failed due to overload even with the continued increase in residential consumption, and second, the ratio of connected transformer capacity to actual demand on the feeders.

Complaints—The company has a very definite policy with regard to complaints, on the basis that good will is created by prompt and careful individual attention to all complaints made. High-voltage complaints, a large percentage of which originate as excessive lamp burn-out complaints, along with complaints of high bills, have increased in recent years. This increase is not, however, chargeable to operating conditions. An analysis of voltage complaints received and the causes of the justified complaints for the central division is shown in Table V.

In this summary voltage fluctuations due to refrigerator load on secondaries are classified as due to "overloaded secondary lines" and the loose connection causes include service entrance switch connections. It is interesting to note that about twice as many high-voltage complaints were received as low voltage, but the justified complaints were equal, high and low.

Comparison of the four divisions of the system on the basis of complaints received per 1,000 residential and commercial customers shows: 2.3 for the central division; 1.4 for the other division included in the central operations; 4.2 each for the other two divisions which do not have the periodic check of voltage control as do the first two divisions. It has been found that the periodic field check locates the low-voltage and overloaded secondaries, although it does not locate all of the fluctuation cases. The two divisions included in the periodic check had only 0.28 justified low-voltage complaints per 1,000 customers compared to 1.4 in the other two divisions.

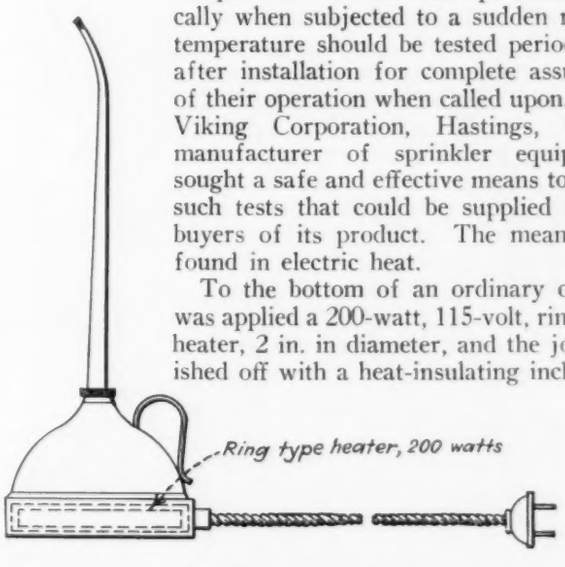
Interference—Radio interference has been reduced steadily and the complaints received during the past two years have been only about one-third to one-half of what they were during 1928 and 1929. Interference from power equipment has reduced to even a greater extent, being about 25 per cent as much in 1933 as in 1929. Only 20 per cent of the complaints received were found to be due to power causes, but here again good will and customer relations justify a liberal policy in investigating all complaints which are made. It is estimated that the inspection costs represent about one-half of 1 per cent of the revenue from radio usage.

Work which has been done for other reasons has helped, incidentally, to reduce radio interference. The change in primary fusing, mentioned in a previous paragraph, is an example. Interference from this cause reduced from 121 in 1930 to fifteen in 1933, eight of which were due to the plug-type boxes, which are being removed from service as fast as economical. Another angle to this inspection work is that many of the power cause interference cases would later develop into more serious trouble. Radios locate troubles, such as loose connections and faulty equipment, in their initial stages.

For Handy Heat Use Electricity

Sprinkler devices that open automatically when subjected to a sudden rise of temperature should be tested periodically after installation for complete assurance of their operation when called upon. The Viking Corporation, Hastings, Mich., manufacturer of sprinkler equipment, sought a safe and effective means to make such tests that could be supplied to the buyers of its product. The means was found in electric heat.

To the bottom of an ordinary oil can was applied a 200-watt, 115-volt, ring type heater, 2 in. in diameter, and the job finished off with a heat-insulating inclosure.



A few ounces of water is poured into the can, the spout screwed back in and the electrical connection made with an extension cord to the nearest outlet. Soon the water begins to boil and steam to spurt out of the spout. The jet of steam is turned on the heat detector under test, which quickly opens if it is O.K. Then the inspector moves his ladder to the next device and tries it in turn.

Largest of Cranes a Triumph in Co-ordinated

350-Ton Hammerhead Structure Has 425 Hp. for and Fleet Apparatus on

By
R. W. MONROE
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Westinghouse Electric
& Manufacturing Company,
East Pittsburgh, Pa.

THE Navy Department has recently placed in service at the Puget Sound Navy Yard, Bremerton, Wash., a large revolving hammerhead crane that is unique in design and lifting capacity. This electric-powered crane is capable of operating with 125 per cent of the normal rated load and the main hoists can raise, lower, rack and rotate 700,000-lb. loads at 115 ft. radius. The operating ranges and speeds are as follows:

Operation	Load, Gross Tons	Speed	Hp. of Motors	Winding
Hoisting (Main)	250	7.6 ft. per min.	(2) 100	Series
Hoisting (Aux.)	30	15 ft. per min.	(1) 50	Series
Racking (Main)	25	40 ft. per min.	(2) 25	Series
Racking (Aux.)	30	100 ft. per min.	(1) 25	Series
Slewing	250	1 rev in 6 min.	(2) 50	Compound

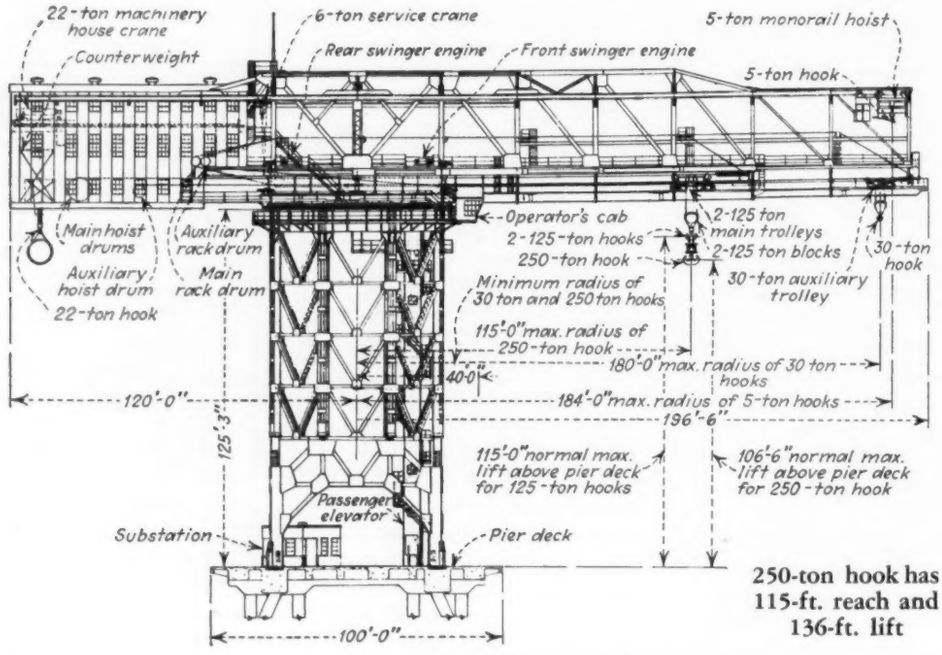
All hoisting, racking and slewing engines are individually driven by electric motors operating on 230 volts d.c. supplied from a substation located at the base of the crane. The motors are of the heavy-duty, totally inclosed, split-frame, mill type, especially suitable for the frequent reversals and heavy loads encountered. Each motor is equipped with an electrically released, spring-set shoe brake with torque rating of at least 150 per cent of full load motor torque. In addition, the main hoists are equipped with emergency brakes of the electrically released spring-set type which are located on the countershaft of the hoisting mechanism.

Electrically released brake shoes on the slewing and racking motors are shunt wound with adjustable discharge resistor to obtain graduated application of the brake shoes for smooth deceleration.

Operator has full command of equipment

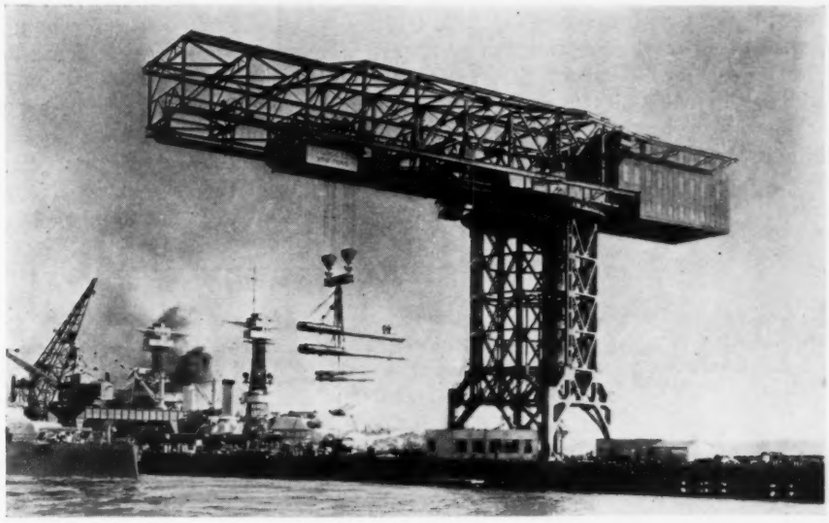
All control is of the full magnetic type. Three ammeters, one for each of the main hoists, and auxiliary hoist motor circuits are located in the operator's cab above the master switches to indicate the approximate load on each hoist. Another indicator panel in the operator's cab includes three synchro-tie receivers which indicate to the operator the positions of the main and auxiliary trolleys along the runway.

A main load of 250 gross tons is carried on a balanced beam supported from two trolleys of 125 gross tons capacity each with a maximum working radius of 115 ft. An auxiliary trolley of 30 gross tons capacity, operating on tracks between the main trolleys, has an extreme working radius of 180 ft. Both the two 125-gross-ton trolleys and the 30-ton auxiliary trolley are of the rope-operated type, with the hoisting and racking engines located in the machinery house. The main hoist engines are equipped with electric clutches for clutching the two engines together, when desired, for dual operation. Electric clutches on the two main trolley racking engines permit similar dual operation of the main trolleys.



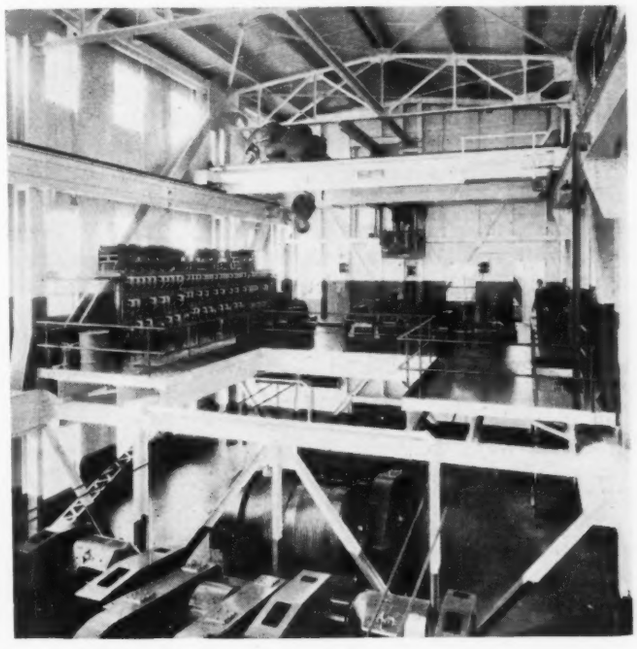
250-ton hook has 115-ft. reach and 136-ft. lift

World's largest revolving crane of the roller-circle turntable type



Power

Placing Naval Guns Ship or Pier



Main and auxiliary hoist engines on the lower floor have direct horizontal leads to trolleys

The racking engines and switchboards are on the upper floor with a 25-ton traveling crane overhead for servicing and maintenance of machinery.

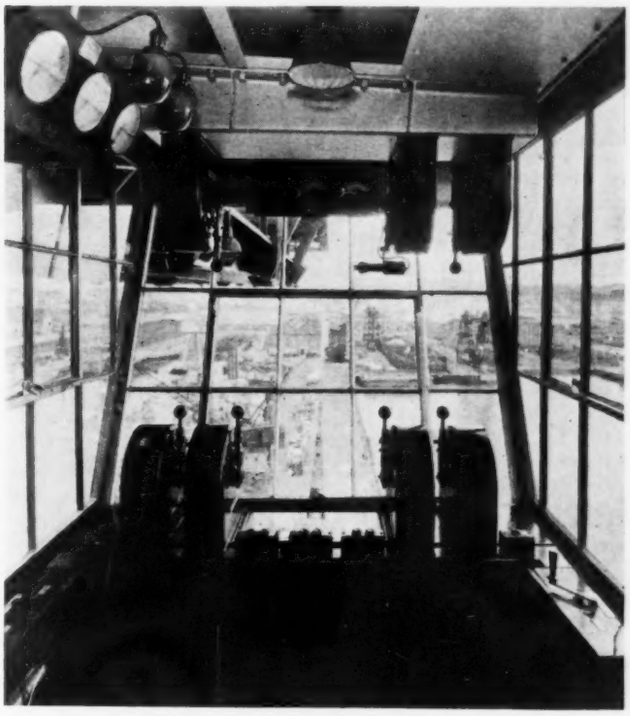
Twelve parts of 1½-in. steel rope support each 125-gross-ton hook. The hoisting rope for each main hoist is in a single piece with the loop around an equalizing sheave toward the front of the beam and with its ends made fast to the motor-driven hoisting drum.

Trolley racking is performed by wire ropes attached to both ends of the trolley; the forward attachment leads around a sheave located toward the forward end of the boom and is carried overhead on supporting sheaves to the racking drum. A second rope attached to the same drum is carried forward horizontally and attached to the rear of the trolley.

Full length travel for auxiliary hoists

In addition to the two main and auxiliary hoists, two 5-gross-ton monorail hoists are included for handling light loads at high speed. These hoists operate on monorails supported by cantilevers from the main structure which extend the entire length of the front and rear cantilever and which are curved at the tower structure to provide clearance when passing the tower with loads.

The rotating member consists of the boom with its front cantilever, 190 ft. long, carrying the trolleys, and its rear cantilever, of 120 ft., carrying a house for the operating machinery and concrete counterweights. The rotor is carried on two semi-circular welded box girders with their rolled steel tracks resting on a live roller circle. Eighty tapered rollers held in correct position by a heavy structural spider rotate smoothly about the kingpin;



Operator's cab affords unrestricted view of all hooks in all positions

Note the three synchro-tie indicators for indicating the positions of the main and auxiliary trolleys along the runway and the three ammeters mounted in front above the operator for indicating the loads on the main and auxiliary hoists.

two independent slewing mechanisms drive vertical pinions meshing with the slewing rack which is attached to the tower structure and thus rotate the superstructure.

A two-story structure on the rear cantilever comprises the machinery house, with the hoisting engines on the lower level in order to provide a direct lead of all hoisting lines to the trolleys, thereby eliminating the use of deflecting sheaves. A 25-ton overhead traveling crane is provided in the machinery house for erection and maintenance of the operating machinery located therein. For servicing the trolleys and the slewing mechanisms a 6-ton hand-operated service crane, which extends into the first panel of the forward cantilever, is provided. For hauling the operator and other attendants from the ground to the cab level there is an electrically operated passenger elevator on the crane.

Dravo Contracting Company designed and erected the crane.

"Part-Winding" Starting Prevents Objectionable Voltage Fluctuations

At the end of a long line this power user found a way to beat drastic starting current limitations

By HOMER W. FORSCHNER

Engineer,
Electric Machinery Manufacturing Company,
Minneapolis, Minn.

DRASTIC limitations of starting current were imposed upon two large synchronous motors driving pulp grinders in the mill of the Manistique Pulp & Paper Company. The grinders, recently electrified, were formerly driven by waterwheels. The changeover occurred simultaneously with the partial abandonment of a private generating plant in favor of power supplied from Sault Ste. Marie by the American States Public Service Company. The motors driving the pulp grinders form a relatively large part of the load at the end of a 135-mile transmission line which supplies energy to the paper mill as well as to the city of Manistique, Mich.

Each of the two motors is rated 1,250 hp., 0.9 power factor, 225 r.p.m. for use on a three-phase, 60-cycle, 2,300-volt system. At full load and rated power factor the kva. drawn per motor is 1,080.

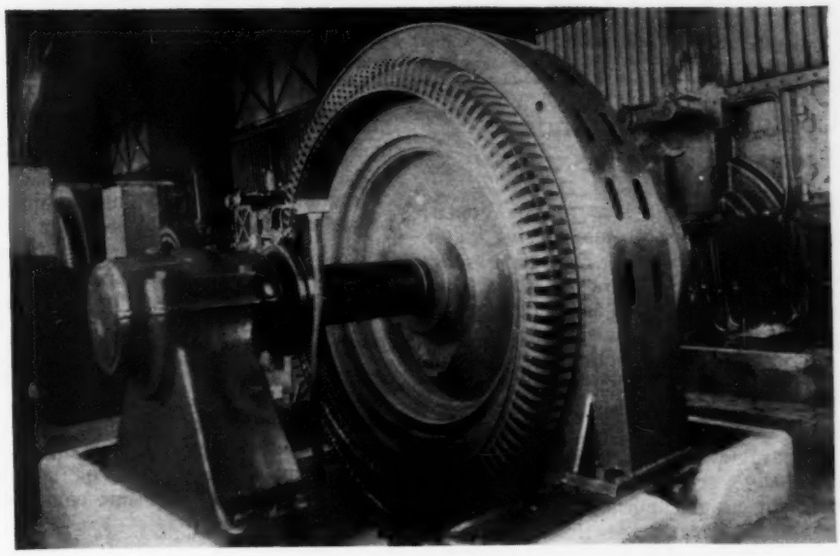
The power company decided that the starting of the motors would not be disturbing to the system if the total kva. inrush would not exceed 1,500, which is only 140 per cent of the full-load value, and providing further that this amount should be reached only by increments, each not to exceed 375 kva., which is 35 per cent of full-load value.

To design the motors with the necessary torque to start the pulp grinders is not difficult. But to design them with such drastic limitations on the kva. drawn at starting has hitherto been considered impossible of attainment in a standard construction synchronous motor. The usual synchronous motor of this speed would require 250 per cent full-load kva. to develop the required torque. Here the kva. was limited to 140 per cent or, roughly, half the usual value.

Several ways were considered of bringing the motor and grinder to full speed. Among these were: (1) Use of the existing waterwheels to accelerate motor and grinder to full speed before application of voltage to the motor. (2) Use of a clutch between motor and grinder, using the running torque of the motor to accelerate the load through clutch slippage.

Analysis showed that a motor directly coupled to the grinder shaft would be most economical and most satisfactory, providing the starting kva. limitations could be met. They were met by a comparatively new starting method extensively used the last three years—"part winding." With this method of starting the stator winding of the motor is divided into any suitable number of parallel circuits, in this case four. The first circuit is connected, thus energizing one-fourth of the winding. Then the second, third and fourth circuits are paralleled

Starting is an acute problem with two big synchronous motors operating as a large part of the load at the end of a long transmission line. And this particular line also supplies general service to many customers. The ingenious solution adopted for this paper mill grinder drive may well find application with other large industrial motor users.



Starting these large motors causes no objectionable voltage disturbances on the line

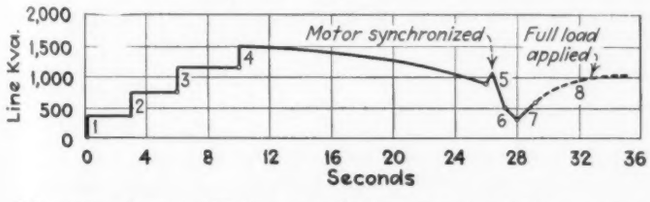
at intervals, the last one completing the energizing of the whole stator winding. The kva. drawn by the motor increases in proportional increments and at no time is the circuit opened.

Ordinarily the stator circuits for part-winding starting are connected directly to the full-line voltage. The very low percentage kva. allowed in this case required the use of reduced voltage at starting in addition to the part windings. The sequence of operation shows how the combination of part-winding and reduced voltage was used. The accompanying graph indicates with corresponding numbers the resulting changes in kva. drawn from the line in the starting sequence.

It is to be noted that there is ample time between steps to allow the line-voltage regulator to compensate for any voltage drop caused by the load increase of the previous step. During operation of the grinder the load is automatically kept at the desired value by use of a Meyer hydraulic governor. This device also acts to reduce the load gradually to zero at time of shut-down. Obviously a quick removal of load is to be avoided as well as quick application of load.

Control is very simple

One control panel serves for the two motors. The main breaker is located adjacent to this panel. The three paralleling breakers for successively connecting three of the motor stator circuits are inclosed and placed adjacent to each motor. Thus only one set of power cables is required from motor to control. The main breaker serves to connect the first of the stator circuits at starting and to disconnect all stator circuits at shut-down. Since the main breaker interrupts the full current at shut-down the paralleling breakers can be of comparatively small interrupting capacity.



No more than 1,500 kva. needed to start 1,250-hp. motor

1. First stator-circuit connected to reduced voltage. 2. Second stator-circuit connected to reduced voltage. 3. Third stator-circuit connected to reduced voltage. 4. Fourth stator-circuit connected to reduced voltage. (Whole stator is now connected at reduced voltage and rotor accelerates as an induction motor to synchronizing speed.) 5. Frequency-actuated field relay closes field contactor to apply direct-current field excitation. Motor then synchronizes. Excitation is applied at reduced value to minimize any disturbance at synchronization. 6. Full-line voltage is applied to stator (motor now operating in synchronism) without opening circuit by Korndorfer transfer from reduced to full voltage. 7. Excitation brought to full value. 8. Full load is gradually applied at the grinder

A minimum of apparatus is required. Although the starting operation involves six major increments plus application of the direct-current excitation, only one standard type auto-transformer is used. No reactors or resistors are necessary as the reactance of the "part-winding" motor stator serves that purpose. Divided into four parallel circuits, the motor stator winding takes the place of four separate reactors during starting. Thus the choking action to cut down the starting kva. takes place in the motor itself, and most of the energy dissipated can act to produce torque, giving a high amount of torque for a given kva. inrush. With the standard reactor or resistor type starter whatever energy is dissipated in the reactor or resistor is lost, and in that case a higher kva. inrush results for a required amount of torque.

The field-responsive frequency relay is used to apply the excitation at the proper speed. In this it serves an important function. Application of the excitation prematurely would result in considerable line disturbance and perhaps stalling of the motor instead of synchronizing. Application of excitation any time after the instant the motor has reached correct speed for synchronizing results in prolonging the starting period, which of course is to be avoided. During operation, if for any reason the motor is caused to drop out of synchronism, the frequency relay immediately removes the excitation. Thus any disturbance by the motor "bucking" to a stop is automatically avoided.

Big motor solved for small line

The installation has met all expectations of satisfactorily starting the load without exceeding the specified current inrush. Thus has been provided a means for successfully starting large synchronous motors of standard construction on systems of small capacity, on the end of long lines, or on networks where relatively small changes in current are allowed. Credit for their part in making this installation successful should go to Frank F. Fowle & Company, Chicago, who are the engineers responsible for designing the transmission line and setting the current limitations at starting. Also to George F. Hardy, New York, who engineered the entire motor installation.

LETTERS TO THE EDITOR

Consumption Depends Primarily on Price

To the Editor of the ELECTRICAL WORLD:

"The influence of inexpensive water power, the absence of competing services and other factors must be considered in studying these data in comparison with data from other sections." This statement is quoted from an unsigned article appearing in the May 26, 1934, issue of ELECTRICAL WORLD entitled, "When Use Is Measured by Comparable Unit Values." It is undoubtedly correct, but in the case of domestic usage, at least, this is true to a far smaller degree than might be directly indicated from the figures. To show this, I have plotted the data given in the article for domestic service, including "municipal only," and other data extending out to an annual use of 4,200 kw.-hr. per customer for Winnipeg.

It is to be noted that all of the points shown are reasonably close to a definite "trend" curve and indicate that no matter where in this country or Canada it is, the domestic consumption of electricity depends very largely upon the price charged for it; moreover, in spite of the depression, there has been a distinct increase in the consumption of electricity per customer for a given price per kilowatt-hour. Between the years 1927 and 1932 this has apparently amounted to about 75 kw.-hr. per annum, as shown by the displacement of the plotted curve from the solid line. Whether or not a point for a certain locality falls on the general trend line probably depends more on the degree to which rates are promotional than on anything else, although by taking averages for sections, as is done in the article, this factor would be very largely eliminated.

In industries, commercial establishments and on farms the amount of energy used by each customer must depend very largely on size, so that some correction for this fact must be applied before comparisons can be made even when using the trend line. Witness the extremely high farm usage in the Western states as given in the ELECTRICAL WORLD article referred to. In spite of this P. P. Stathas has found a definite trend line to include all classes (N.E.L.A. Bulletin, August, 1932).

The important point is that comparisons between localities cannot be made properly unless the relation of the data to the trend line is taken into consideration.

R. P. MOORE.

Buffalo, Niagara & Eastern Power Corp., Buffalo, N. Y.

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Appliance Safety in Adequately Cured Cement

To the Editor of the ELECTRICAL WORLD:

May I at this late date comment on an article in ELECTRICAL WORLD of June 16th?

The approach to the research on such an important subject seems to have been a little too casual. There is a lack of exactness in the conditions and terms used. For instance when a substance is *baked* it is not necessarily *vitrified.* The refractories in most heating units being discussed cannot be said to be vitrified to 900 deg. C. The measurement of temperature of the unit outside the casing by means of a thermocouple does not appeal as being accurate. At best it is a means of comparison and its records are likely to be quite misleading. The diameter of the thermocouple wire should be stated.

The thickness of the cast iron pieces is of importance if the results are to be interpolated for other thickness of casings. It would be of interest to know if the results differed very much without the 15 lb. weight. The writer's experience shows that units can be made to withstand varying pressures up to hundreds of pounds per square inch without changing electrical data.

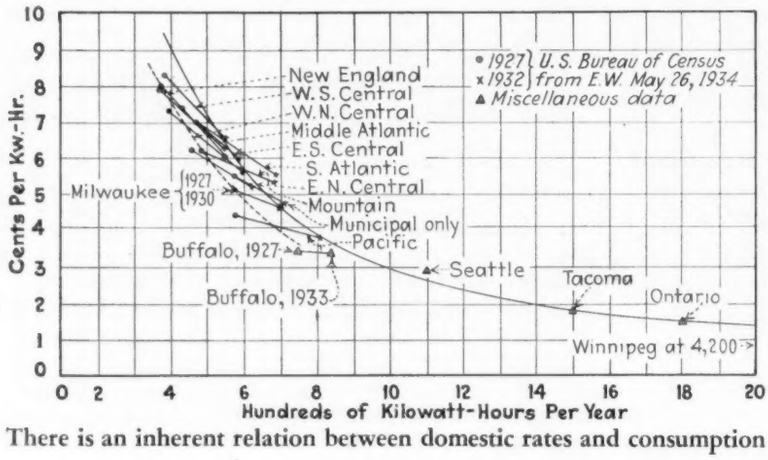
No mention is made of mesh size of the grain or powder, nor the shape of the grain. With regard to the hygroscopic tendencies mentioned in several places in the article—do the authors mean to say that the 900 deg. C. is sufficient to vitrify and to render moisture proof the units, or if not what temperature does constitute "thorough firing." For instance, assume that the vitrifying temperature of the insulation was equal to 1427 deg. C. and the heating unit casing was iron or carbon steel this could only be achieved under the condition of a special atmosphere in the furnace and even then there would be considerable risk of scaling of the casing. The writer is of the opinion that the safe way to build electric heating units is to be certain that all the refractories are vitrified to at least 1427 deg. C. before assembly.

Referring to the thickness of insulation found to be safe from "short circuiting" (should not this be grounding?). This cannot be settled off hand by putting in $\frac{1}{8}$ or $\frac{3}{16}$ in. of refractory as the problem of temperature gradient must be taken into consideration.

The writer believes that the authors have begun to openly tackle a question which will demand as much attention as other electrical design, and it is to be hoped that they will be able to offer further contribution based on more exact terminology of the materials involved. The characteristic curves which they have developed should be extended with more and different substances and will then be of considerable value.

H. E. TRENT.

Philadelphia, Pa.



There is an inherent relation between domestic rates and consumption

BOOK REVIEWS

E. E. I. Committee Reports

No. B4, Turbines, 1934. 18 pages, illustrated. Price, $1 to U.S.A. non-members; $1.10 foreign.

Has operating records for 310 large turbines and for fifteen operating above 1,000 lb. Discusses oil piping hazards, blade erosion, laying-up practices, new developments.

No. B3, Condensers, Feedwater Heaters, Evaporators and Boiler Feed Pumps. 22 pages, illustrated. Price, $1.15 to U.S.A. non-members; $1.25 foreign.

Gives operating experiences on condenser maintenance, tube life, rehabilitation for bettered performance, reduction of aeration. The material on feedwater heaters, boiler feed pumps and evaporators is digested from eighteen operating companies' statements.

NEWS OF THE WEEK

Roosevelt Repeats Power Promises

Pledges government to further greater power developments. Federal yardsticks to be numerous. Nation to be made "dam-minded." Grand Coulee may rise high above level in present plans.

REITERATING earlier assurances that there would be government yardsticks "so that the people in this country will know whether they are paying the proper prices for the electricity of our times," President Roosevelt visited the Pacific Northwest late last week. Two speeches were made, one at the site of the Bonneville Dam on the Columbia and the other at the Grand Coulee site on the same river.

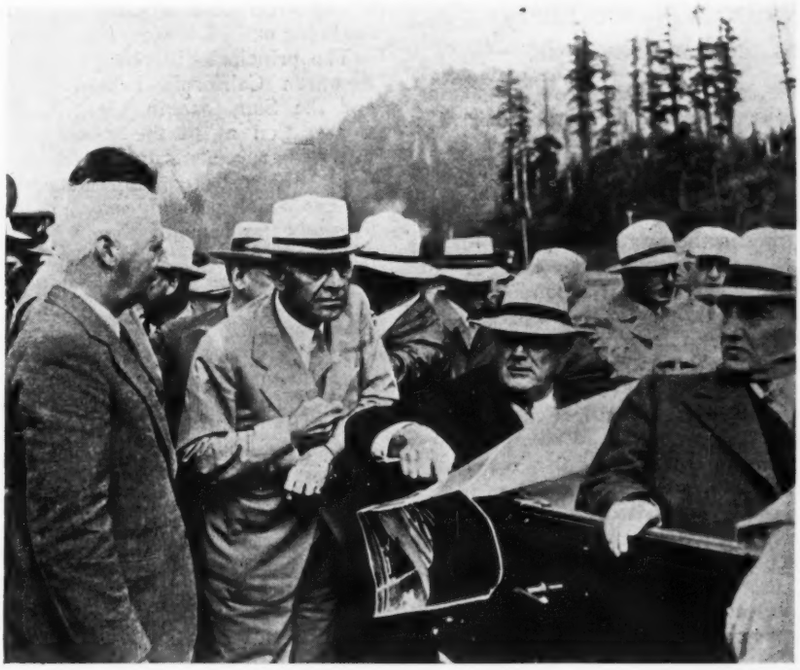
Linking power and river transportation in his Bonneville speech, Mr. Roosevelt said: "I always believed in the old saying of 'More power to you.' I don't believe that you can have enough power for a long time to come, and the power we are developing here is going to be power which for all times is going to be controlled by the government. Within three years I hope the Bonneville Dam will be an actual fact, and this fact will militate very greatly for the benefit of the lives not only of the people of Oregon and Washington but for the whole course of life of the people of the United States."

A dam-minded people

At Grand Coulee the President referred to "the process of making the American people 'dam-minded.' "People are going to understand some of the implications of building dams in the higher stretches of rivers all over the country," said Mr. Roosevelt.

In connection with the Columbia River development he stated: "We are going to see, I believe, with our own eyes, electricity and power made so cheap that they will become a standard article of use, not only for agriculture and manufacturing, but also for every home within reach of an electric light line. The experience of those sections of the world that have cheap power proves very conclusively that the cheaper the power the more of it is used, and that makes me believe that this low dam which we are undertaking at the present time is going to justify its existence before it is completed by our being able to contract for the sale of practically all of the power it will develop. And if we are justified in that hope we come down to chapter two, which is the building of the high dam."

BONNEVILLE PROJECT UNDER DISCUSSION



Wide World

Following his arrival in Portland, Ore., from his vacation cruise, President Roosevelt studies with construction leaders a map of the new $45,000,000 Bonneville Dam project as he visits the dam site. Left to right: Col. T. S. Robbins, district engineer; George Dern, Secretary of War; President Roosevelt and Gov. Julius Meier of Oregon.

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Energy Consumption Raised by T.V.A. Residential Rates

First reports on results of low T.V.A. rates and the promotional activities of Electric Home and Farm Authority in Tupelo, Miss., and Athens, Ala., are characterized as highly satisfactory by David E. Lilienthal. As shown by Mr. Lilienthal's report in Tupelo, the residential use in July, 1934, showed an increase of 16.2 per cent over June, 1934, a 75.4 per cent increase over February, 1934, which was the last month under old rates, and an 83.2 per cent increase over the same month in 1933.

In Athens, where T.V.A. rates have been in effect for two months, the first month, June, showed a 22 per cent increase in residential use over May. In July residential consumption increased 16 per cent over June and for the period of June 18 to July 18 this year the use was 48 per cent greater than for the same period in 1933. All of these increases, Mr. Lilienthal pointed out, were made in the face of a normal seasonal decline in power consumption.

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Public Works' New Budget Cut $100,000,000

Somewhere in the course of setting up the government's budget for the new fiscal year pressure on the appropriation made for the Public Works Administration has resulted in a reduction of $100,000,000. The maximum of $500,000,000 that Congress allotted for public works by direct appropriation has become "not more than $400,000,000." The only explanation offered by P.W.A. is that possibly officials construed as public works, to which the half-billion-dollar maximum should apply, separate provision of $65,000,000 for federal buildings, which were taken from P.W.A.'s supervision, and $40,000,000 for naval construction.

Will Home Electrification Follow Low Rate Levels?

Cheap power alone is not sufficient inducement to bring about wholesale home electrification, the Chamber of Commerce of the United States maintained in a report made last week on trends in the cost and use of electric light and power in homes and the difficulties in home electrification. Other factors than rates, the report declared, must be considered in any universal electrification plan, such as incomes, appliance costs, competitive service and the like. Data in the report were supplied by both privately and publicly owned utilities.

The chamber declared that its report was made without taking sides in the controversy involving the electrical industry, but merely for the information of its members in whose communities electric rates charged by public utilities are under discussion.

The report estimated that "the general electrification of our homes would require an investment of fifteen or twenty billions of dollars for appliances alone, not including air conditioning." "Even with substantial reductions in equipment cost and energy cost," it said, "it is questionable whether the economic status of the potential 'electrified home' customers is such that the growth of home electrification can be greatly accelerated unless forced by some artificial stimulus such as a government subsidy.

"At any rate, it is a fair presumption that the best markets have been well covered by electric appliance salesmen, and that further sales must encounter lower incomes, greater competition, higher distribution costs for energy and greater sales resistance because of customs of living and general social conditions. Until such conditions can be overcome rate adjustments must of necessity follow practical lines that tend to keep every customer's usage profitable."

The outstanding change that has come over the residential customer service within the last decade, the chamber's report said, "is that it is no longer 'monopolistic' but a competitive service.

"There is persistent competition for a share of the consumer's dollar. More and more as modernization of household equipment is desired, that desire will be met through the perfection of appliances and their manufacture at costs and their operation at rates which, when taken together, are intended to persuade the customer to abandon the service he now has and take on the electric way. The value of the service as thus determined by the customer himself has in large measure become the true yardstick of rates for domestic electric service."

COMING MEETINGS

Economic Conference of Engineers—Fourth annual meeting, Stevens Institute of Technology Engineering Camp, Johnsonburg, N. J., August 11-19. Harvey N. Davis, Stevens Institute of Technology, Hoboken, N. J.

International Association of Municipal Electricians — Wardman Park Hotel, Washington, D. C., August 29-Sept. 1. W. H. Harth, City Hall, Columbia, S. C.

Producers and Distributors of Electrical Energy—Fifth International Congress, Zurich and Lausanne, Switzerland, August 29-Sept. 7. Secretary, Union des Centrales Suisses d'Electricite, 301 Seefeldstrasse, Zurich.

American Institute of Electrical Engineers—Pacific Coast Convention, Salt Lake City, Utah, September 3-7. General Convention Committee, 1016 Continental Bank Bldg. Salt Lake City, Utah.

Rocky Mountain Electrical Association—Annual convention, Estes Park, Colo., September 10-12. G. E. Lewis, Managing Director, Gas & Electric Bldg., Denver, Colo.

Association of Iron and Steel Electrical Engineers—30th convention, held in conjunction with the Iron and Steel Exposition, Cleveland, Ohio, September 18-20. J. F. Kelly, Empire Bldg., Pittsburgh, Pa.

National Electrical Exposition — Madison Square Garden, New York, N. Y., September 19-29. Ralph Neumuller, Electrical Association of New York, Grand Central Palace, New York.

Electrochemical Society — Sixty-sixth convention, Hotel Pennsylvania, New York City, September 27-29. Colin G. Fink, Columbia University, New York.

Illuminating Engineering Society — Annual convention, Baltimore, Md., October 1-4. D. W. Atwater, Secretary, 29 West 39th Street, New York.

National Electrical Manufacturers Association — Annual meeting, Chicago, October 17-20. W. J. Donald, 155 East 4th St., New York.

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Available Hydro Energy Reduced by Drought

The long-continued drought has materially reduced the amount of hydro-electric energy available for use in the Mississippi Valley and various other parts of the country. In St. Louis the energy coming from water-power sources in the first seven months of this year was approximately half of that available in the corresponding period last year. Louis H. Egan, president of the Union Electric Light & Power Company, has explained that the huge hydro plants of the company at Bagnell, Mo., on the Osage River, and at Keokuk, Iowa, on the Mississippi River, have been operating at the lowest output in many months. According to Mr. Egan, July was the fourteenth consecutive month in which there has been a deficiency of rainfall in the watershed of the Mississippi River, and flow through the dam at Keokuk was only 32 per cent of the average for this season of the year.

As a result the company is relying heavily on its Cahokia and Ashley Street steam generating plants. The reserve capacity of these plants is sufficient to provide against a shortage.

Present surface water conditions in the Southeast are in marked contrast with the prevailing drought in other sections of the country. The storage reservoirs of the great southeastern hydro-electric systems are full and little steam reserve capacity is running. For the next few months at least southeastern farmers, municipalities and power companies will need to have no concern for their water resources.

. . . THIS WEEK IN WASHINGTON

Large enrollment in Tennessee Valley Associated Co-operatives reported—Knoxville utility's appliance sales high.

IN HIS report to the President's executive council, Arthur E. Morgan, head of the Tennessee Valley Authority, reports that 1,953 families have been enrolled in Tennessee Valley Associated Co-operatives and that 3,750 more are expected to join before the end of the year. Four new projects are awaiting approval which will provide opportunities for 2,150 additional families. The co-operatives engage in canning, flour grinding, handicraft, textiles and seed potato cultivation. The government has advanced $300,000 thus far, only a part of which has been allocated. Mr. Morgan also reports that T.V.A. has paid the state of Alabama $40,000, representing its 5 per cent of the gross proceeds of power sales. The Tennessee Electric Power Company, Mr. Morgan states, has sold 6,700 refrigerators, ranges and water heaters in ten weeks, one-fourth of total sales during the preceding twelve years.

Reduction in the scheduled budget of $48,000,000 for the Tennessee Valley Authority to $25,000,000 has made it impossible to proceed with the plan to construct dams at Pickwick Landing and at Aurora and to build storage reservoirs on the Hiwassee and on the French Broad River. Surveys of these projects are being pushed, however.

The principal difference between the Southern California Edison Company and the San Joaquin Light & Power Corporation as to the value of headwater improvements lies in the proportion of the cost of conduits between reservoirs which properly may be charged to headwater benefits. Roger McWhorter, chief engineer of the Federal Power Commission, recently made a personal inspection of the project work involved. The commission is expected to render a decision in the near future as to the annual payment to be made to cover that portion of the carrying charge on these conduits and other headwater improvements that may be held to benefit the San Joaquin corporation.

PAUL WOOTON,
Washington Correspondent.

Power Commission to Fix Santee-Cooper Price

Acting on the joint petition of the South Carolina Public Service Authority and the Columbia Railway & Navigation Company, owners, the Federal Power Commission has agreed to make a determination of the actual legitimate cost of the Santee-Cooper waterpower project, on the Santee and Cooper Rivers in South Carolina. The results will be used as a basis for the transfer of the property from the company to state ownership in the event that a loan for that purpose is approved by the Public Works Administration. Both parties have agreed to accept the commission's determination as the purchase price.

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Equipment Order Placed for African Station

Contract has recently been placed by the Victoria Falls & Transvaal Power Company, Ltd., for generating plant equipment to be installed in the new Klip River station, South Africa, with the Metropolitan-Vickers Electrical Company, Manchester. The contract covers the supply of three turbo-alternator sets, each of 33,000 kw. capacity, complete with condensing plant. The turbines will be of the two-cylinder impulse type, the low-pressure cylinder in each case being designed for double flow of steam exhausting into a twin condenser of the central flow surface type.

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British Grid Suffers First Serious Breakdown

For the first time since its inauguration Britain's electrical grid suffered a serious breakdown on July 29, which dislocated electricity supply in southeast and east England, and places as far as Peterborough in the north, Twickenham in the west and Brighton in the south, as well as parts of London and the home counties, were affected. This was immediately followed in London by another breakdown at the huge County of London electric station, Barking. Parts of east London were entirely without energy for about twenty minutes as a result. The Central Electricity Board has issued the following statement on the breakdown:

"At 11:45 a.m. trouble developed at the Battersea power station of the London Power Company. The whole of the export of that company to the grid system of southeast and east England was interrupted, leaving the remainder of the stations to deal with the full load. Owing to the reduced demand on Sundays fewer stations were in active operation than ordinarily. They would have been able to carry the additional load, but the abnormal 'fault' current suddenly called for was beyond their capacity.

"In order to readjust matters it became necessary to disconnect the stations and start the system up again in sections. This accounts for the variation in the duration of the interruptions of supply throughout the area."

The interruptions varied from half an hour to nearly four hours. The definite cause of the breakdown has not been determined.

•

Soviet Power Plant Opened

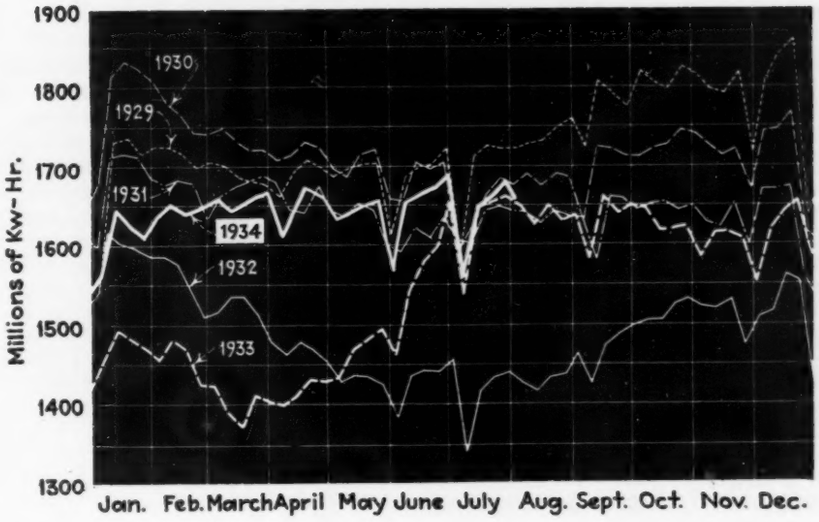
After long test operations proved it satisfactory, the Rionges hydro-electric plant, largest in the Caucasus, has been officially opened in the Georgian Soviet Republic. It has a capacity of 50,000 kw. and will supply energy to cities and industries over a wide range in Transcaucasia.

•

Storm Damages Property

Consumers Power Company suffered property damage estimated at about $500,000 August 3 in a wind and rain storm which swept southern Michigan, killing eleven persons, injuring more than 40 and destroying $2,500,000 in property. Most of the power damage was in the vicinity of Flint, where for hours the lighting system failed completely and electrically motivated equipment, including street cars, was stopped. All available trouble shooting crews of the Detroit Edison Company were sent out on emergency calls into the Oxford, Orion and Rochester areas.

Energy Output Declines



Losses in the New England, Middle Atlantic, Central industrial and Southern States regions more than canceled gains in the West Central, Rocky Mountain and Pacific Coast regions in the week ending August 4 and brought the national output of electrical energy down 1.5 per cent from that of the previous week. As reported by the Edison Electric Institute, the total for the United States was 1,657,638,000 kw.-hr., a gain of 0.5 per cent over the corresponding week of 1933, as compared with a gain of 1.3 per cent in 1934-33 for the week ending July 28.

A similar tendency to decline in early August was demonstrated in 1933 and 1932, although the present decline is sharper than that encountered in either of those years.

The Central industrial region shows a decline of 2.6 per cent compared with last year, whereas in the week previous it showed a gain of 0.2 per cent. Southern States gains were cut from 4.0 to 1.7 per cent. Pacific Coast improvement jumped from 4.6 per cent for the week ending July 28 to 8.2 per cent as of August 4.

Weekly Output, Millions of Kw.-Hr.

1934	1933	1932
Aug. 4...1,658	Aug. 5...1,650	Aug. 6...1,427
July 28...1,684	July 29...1,662	July 30...1,440
July 21...1,664	July 22...1,654	July 23...1,434
July 14...1,648	July 15...1,648	July 16...1,416
July 7...1,556	July 8...1,539	July 9...1,342

Per Cent Change from Previous Year

Region	Week ended Aug. 4	July 28	July 21
New England	— 8.6	— 7.1	— 9.0
Middle Atlantic	+ 1.0	+ 1.7	+ 3.0
Central Industrial	— 2.6	+ 0.2	— 0.1
West Central	+ 9.7	+ 8.7	+ 4.8
Southern States	+ 1.7	+ 4.0	+ 1.2
Rocky Mountain	— 1.5	— 3.0	— 2.0
Pacific Coast	+ 8.2	+ 4.6	+ 5.1
United States	+ 0.5	+ 1.3	+ 0.6

As to Rates . . .

• Boston Edison Company has been ordered by the Massachusetts Department of Public Utilities to reduce residential and commercial rates from 7½ cents to 7 cents per kilowatt-hour. It is estimated that this will result in a saving to customers of approximately $800,000 annually. The commission has also ordered the company to discontinue the free lamp service. At the suggestion of the commission the Edison company has agreed to set aside not less than $865,000 quarterly for depreciation. The commission stated that in its opinion it would be to the interest of the public and the company if the construction indebtedness (coupon notes) were taken up by bonds or stock. The rate cut becomes effective on and after September 1 and the company is ordered on or before August 15 to file a schedule of rates with the department. Relative to the New England Power contract, the commission said: "Viewed in the light of the circumstances that then obtained, we do not feel that we would be justified in finding the contract either improvident or imprudent. We think it would be unreasonable to find that the management of the company in 1928 should have foreseen the depression which began in the fall of 1929."

• Commonwealth Edison Company's rate investigation by the Illinois Commerce Commission has been continued until September 12 to permit more time for the preparation and study of data relating to historical cost of properties and operating costs. Figures are being submitted to the commission from time to time as prepared and it is expected that under this procedure the cost of investigation will be reduced and much less time will be consumed in hearings before the commission.

• Georgia Power & Light Company's petition for an order to enjoin the State Public Service Commission from reducing its rates was denied by a three-judge federal court on the grounds that the court had no jurisdiction. The court maintained that the company had been given a reasonable hearing before the state commission and that, therefore, the federal courts had no jurisdiction under the terms of the Johnson bill, which provides that injunctions restraining state regulatory bodies from lowering utility rates shall be obtained in state courts unless the utility could prove it had not been given a reasonable hearing.

• Philadelphia Electric Company's rate case before the state Public Service Commission has been postponed indefinitely by Commissioner Frederick P. Gruenberg, following the granting of an order by the Dauphin County Court requiring the commission to show cause why an injunction restraining the commission from disbarring City Controller S. Davis Wilson from the hearings should not be granted.

• Bronx Gas & Electric Company's electric rate hearing before the New York Public Service Commission has been continued until September 7. Testimony concerning electric rates, introduced in the old gas and electric rate proceedings started last year, was put into the new case to establish separate proceedings for both electric and gas rates.

• Empire Gas & Electric Company's rate hearing before the New York Public Service Commission has been adjourned until September 6.

• Alabama Power Company has been ordered by the state Public Service Commission to make a state-wide revision of its "room differential" charge, which will result in a saving of $25,000 to 73,000 urban customers.

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Utah Municipal Plant Sued for Sales Tax

Whether consumers of electricity, gas and heat purchased from a municipal system are liable for the 2 per cent sales tax levied by the 1933 Legislature is to be determined in a suit filed by the State Tax Commission against the municipal electrical system of Lehi in the fourth district court of Utah. Twenty-one cities in all are affected by the suit.

The law levied the 2 per cent tax against all consumers and made the supplying utilities liable for collection. It is reported that the majority of the municipal utilities in the state have ignored its provisions entirely. Validity of a law imposing a 3 per cent tax on the gross revenues of all electric utilities, whether privately or municipally owned, was recently upheld by the Washington State Supreme Court.

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Sacramento Plan Advances

Under the terms of a contract closed last week Burns & McDonnell, consulting engineers of Kansas City, will prepare estimates on the cost of a complete distribution system for the Sacramento Municipal Utility District (ELECTRICAL WORLD, July 28, page 126). The district's board of directors announced that the report will be completed by September 20 so that a bond election can be placed before voters at the general election November 6. They pointed out that by obtaining such an engineering report they hoped to be able to negotiate directly with the Pacific Gas & Electric Company for its distribution system without the formality of a valuation by the California Railroad Commission followed by condemnation proceedings. Alternative step would be the construction of a competing system.

•

Iowa Utility Seeks Stay on Injunction Invalidation

Petition has been filed with the Iowa Supreme Court by the Iowa-Nebraska Light & Power Company for a stay order enjoining the city of Corning from erecting a municipal power plant. The stay order application follows a decision of the Adams county district court which recently dissolved a temporary injunction obtained by the power company (ELECTRICAL WORLD, August 4, page 158).

•

P.W.A. Municipal Loan Case Carried to Supreme Court

Suit was brought last week by the Consumers Power Company of Portland, Me., against the city of Allegan, Mich., in the United States Supreme Court to forestall the loaning of money by the Public Works Administration to that municipality for the construction of an electric lighting plant. A loan by P.W.A. last December of $410,000 was made to the Michigan city, of which the federal government contributed 30 per cent as a gift and proposed to secure the remainder as a loan, taking 4 per cent general obligation bonds and first mortgage bonds to be issued by the city.

As a taxpayer in Allegan, the power company brought suit in the Federal District Court for Western Michigan, which last January enjoined the city from issuing additional general obligation bonds, taking the position advanced by the power company that the city had reached the limit of its bond-issuing power. The power company also sought to have declared invalid the section of the recovery act under which the President is authorized to extend aid to states and municipalities, notwithstanding any restrictions placed on the power of the state or municipality to borrow money or incur indebtedness.

The Sixth Circuit Court of Appeals set aside the injunction issued by the district court, holding that the validating act passed by the Michigan Legislature in March last permitted the issuance of additional bonds which had, at that time, been approved by a majority of the voters of the city. The Appellate Court declared that as the validating act had the effect of authorizing the city to go forward with the P.W.A. loan, it was not necessary for it to pass on the validity of the section of NRA challenged by the power company.

FINANCIAL · · · BUSINESS

Utility Bond Sale Upheld by Court

Long Island Lighting Company wins decision in $6,845,500 deal. Receivership and judgment asked.

Supreme Court Justice Valente denied last week an application by two stockholders to restrain the Long Island Lighting Company from selling $6,845,500 first refunding mortgage bonds to the Metropolitan Life Insurance Company and the East River Savings Bank. No evidence that terms of the proposed transaction were improvident, as charged, appeared in the evidence, Justice Valente held.

Stockholders overruled

The plaintiff's petition was in opposition to the terms of the contract between the company and the insurance and banking institutions. Overruling the stockholders' charges, Justice Valente held that "in providing safeguards which will insure the ultimate redemption of the bonds and the reorganization by possible default in the future, the plan in the long range protects the interests of the stockholders. Nor does the plan appear to require renewed consent of the stockholders, he said.

After the New York Public Service Commission had authorized the company to issue, not later than September 1, not to exceed $6,382,800 principal amount of first and refunding mortgage bonds, series B, 5 per cent, Milo R. Maltbie, chairman, said that while the commission cannot directly compel a company to register new issues with the Federal Trade Commission, applications involving issues without registration will hereafter not be approved unless there are compelling reasons for such a course.

Charging the officers and directors with fraud, a group of preferred-stock holders have filed in the Bronx County Supreme Court a petition asking appointment of a receiver for the company and a judgment of $15,000,000 in its favor. Ellis L. Phillips, president of the company, it is asserted in the brief, obtained large profits from the company through payments made to E. L. Phillips & Company, his own construction company. Moreover, excessive dividends, it is alleged, were paid on the common stock, of which Mr. Phillips is, or was, the largest single stockholder.

Answering the fraud charges, Mr. Phillips characterized the statements in the complaint as "reckless and wholly unjustified."

CATASTROPHE

Just at the moment when it seemed psychologically, if not politically, possible to substitute recovery for reform in Washington thinking there has arisen the third "r" of relief to absorb and presumably direct Administration attention for some time to come. Losses of $5,000,000,000 in drought-stricken areas, as reported to the President, scarcely encompass the full facts of the national disaster which has completely overwhelmed more artificial elements in farmer-economic relationships.

Business facts of the week will increasingly drive their impulses directly and indirectly from the drought. Wheat and other commodities at high levels. International pressure on the dollar, in anticipation of radical inflation, renewed. Tinplate production up to meet immediate canning needs.

Energy output dropped 1.5 per cent from the levels of the week previous, but remained 0.5 per cent above last year. Steel output off to about 26 per cent of capacity. Carloadings off 1 per cent from previous week. General indexes up slightly. Lumber output up on lower prices. General trade as reflected in retail store sales of the week equals 1933 high figure.

Better Light-Better Sight Bureau Links Many National Interests

Work of the past year to be continued on greatly augmented scale with electrical industry efforts co-ordinated with those of others. Comprehensive promotional plans already under way.

REPLACING the special committee of the Edison Electric Institute which for the past year has sponsored the "Better Light-Better Sight" campaign, a National Better Light-Better Sight Bureau was formally organized on August 1. Backed by eleven national trade associations officially represented in the organization and linking a total of 21 groups interested in eyesight conservation and lighting sales, the bureau constitutes a voluntary, non-profit enterprise, underwritten as to necessary finances by the Edison Electric Institute, the General Electric and Westinghouse Electric & Manufacturing companies. The undertaking will be an educational, social and market-building enterprise. M. E. Skinner of the Niagara-Hudson Power Corporation, who was chairman of the special E.E.I. committee heretofore so functioning, is chairman of the newly organized bureau. M. J. Julian, president of the Better Vision Institute, is vice-chairman. The executive committee consists of H. F. Barnes of General Electric, J. F. O'Brien of Westinghouse and C. E. Greenwood of E.E.I. G. R. Trumbull is manager of the bureau with headquarters at E.E.I. offices in New York.

Associations actively participating in the formation of the National Better Light-Better Sight Bureau were: Better Vision Institute, National Paint, Varnish and Lacquer Association, National Clean-Up and Paint-Up Campaign Bureau, Artistic Lighting Equipment Association, National Electrical

BETTER LIGHT FOR BETTER SIGHT
Be quite sure that Eyes are right
Lots of Light... no bulbs in sight
Keep all walls and ceilings Light
Add them up for Better Sight

Shield symbol adopted by National Better Light-Better Sight Bureau

Wholesalers Association, Illuminating Engineering Society, National Retail Dry Goods Association, National Retail Hardware Association, National Retail Furniture Association, National Electrical Manufacturers Association, National Bureau of Casualty and Surety Underwriters.

Activity widely pushed

Promotional campaigns with literature to be distributed to participating groups has been prepared on a scale seldom used. It is expected that the activities of the Better Light-Better Sight Bureau will thoroughly rival the work of the Electric Refrigeration Bu-

reau. General Electric, Westinghouse and National Clean-Up and Paint-Up Campaign Bureau have comprehensive publicity programs in virtually full completion.

Such a development as the formation of this national bureau to unite all interests in correlated activities toward better aim at the common objective of eyesight conservation and sales of their own products was foretold at the Atlantic City convention of the Edison Electric Institute this year (ELECTRICAL WORLD, June 9, page 824). The formation of local bureaus will be encouraged, but not pushed.

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Utility Plant Valuations Advanced in Washington

Property valuations of private utility plants in the state of Washington have been increased $10,247,120 by an order on file with the state Tax Commission and county assessors have been requested to make the valuation adjustments on 1934 assessments.

The greatest single increase affected the Puget Sound Power & Light Company, whose valuation was advanced $8,176,542. Other public utilities valuations were increased as follows: Chelan Electric Company, $835,720; Inland Light & Power Company, $115,357; Interstate Power & Light Company, $21,113; Northwest Electric Company, $142,920; Northwest Improvement Company, $11,875; Pacific Power & Light Company, $398,734; Washington Water Power Company, $541,930; Olympic Public Service, $2,929. H. H. Henneford, chairman of the commission, declared "these valuations are only a beginning in correcting assessment inequalities in the state."

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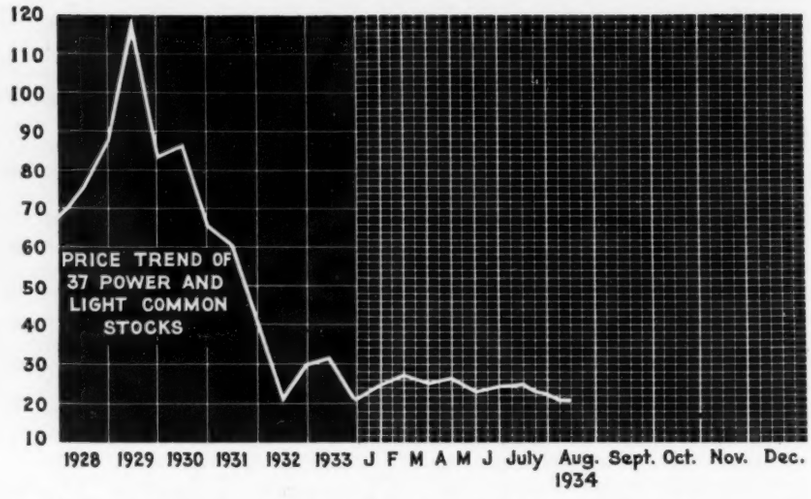
Consolidated Gas Loses Affiliate Loan Plea

Petition of the Consolidated Gas Company of New York and its affiliated companies for permission to make intercompany loans from time to time on open account was denied last week by the Public Service Commission. In their petition the companies set forth the maximum amounts proposed to be lent or borrowed by the various companies. Under the the new public utility laws adopted in New York State last spring the commission received authority over such loans, and the Consolidated Gas group of companies thereupon sought a blanket authority to facilitate its operations. The petition was from the Consolidated Gas Company of New York, New York Edison Company, Brooklyn Edison Company, Astoria Light, Heat & Power Company and Standard Gas Light Company.

Slight Changes in Utility Stocks



Stocks moved irregularly during the past week without important net changes in either direction. Fluctuations in the light and power list were insignificant. *Electrical World* index 20.9 this week; last week, 20.8.

Utility Bonds Deposited

More than 61 per cent of the $9,824,000 Pacific Northwest Public Service Company 6 per cent debentures have been deposited under the plan of reorganization proposed by the Portland Electric Power Company, formerly the Pacific Northwest Public Service Company. Deposit of at least two-thirds of the bonds is required to make the plan effective.

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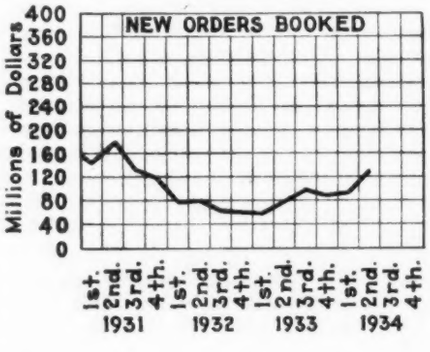
Electrical Manufacturing Gained in Second Quarter



New orders booked during the second quarter of 1934, as reported to the Bureau of the Census by 78 manufacturers of electrical goods, exceeded those for the corresponding period last year by 60 per cent. The total was $128,033,723, as compared with $92,302,245 for the first quarter of 1934 and $79,856,484 for the second quarter of 1933. The totals include motors, storage batteries, domestic appliances and industrial equipment and are presented, not as a complete statement of the industry, but as sufficiently representative to indicate the trend.

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Washer Shipments in 1934 Reach New High

Household washer shipments for the six months ended June 30 broke all industry records for the first half of any year, Joseph R. Bohnen, secretary of the American Washing Machine Manufacturers' Association, announced this week. Washers shipped dealers by 31 manufacturers in the first half of 1934 totaled 679,624, compared to 625,094 in the next highest comparison period, the first half of 1929, and 395,344 in the opening six months of 1933.

Ironer shipments reported by the twenty companies marketing them for the first six months totaled 57,991, compared to 25,766 in the same period of 1933. June washer shipments were 94,890, compared to 93,508 in June, 1933, and to 79,000 in the next highest June, 1929. Ironers shipped totaled 7,304, compared to 6,342.

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General Cable Profit $89,789 in June Quarter

Report of the General Cable Corporation for the six months ended June 30 shows net loss, after taxes, depreciation, interest and other charges, of $240,007, compared with $1,588,467 loss in the first six months of previous year. For the quarter ended June 30 net profit

amounted to $89,789, equal to 59 cents a share on 150,000 7 per cent preferred shares, compared with net loss of $329,796 in preceding quarter and $611,489 loss in the second quarter of 1933.

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Westinghouse to Sell Ranges to Employees

Paralleling its plan of action in selling electric cookery to prospects in the field, the merchandising division of the Westinghouse Electric & Manufacturing Company is sponsoring a new campaign having for its purpose the sale of 1,000 electric ranges to employees. This campaign, to last a month, will be staged not only at the headquarters of the merchandising division in Mansfield, but will be actively promoted throughout the various offices and provinces of the company, its subsidiaries and the Westinghouse Electric Supply companies.

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Yale & Towne Profit Up in Second Quarter

Net profit of the Yale & Towne Manufacturing Company for the six months ended June 30 after depreciation, taxes and other charges totaled $62,265, equal to 13 cents a share on 473,556 $25 par capital shares outstanding on December 31, 1933, compared with net loss of $189,417 in the first half of last year. For the quarter ended June 30 net profit was $41,011, or 9 cents a share, compared with $21,254, or 4 cents a share, in preceding quarter and net loss of $82,324 in second quarter of 1933.

•

Switchgear Company Formed

Under the title of Switchgear Testing Company, Ltd., a company has been registered to operate the large power circuit breaker testing plant which has been built at Trafford Park, Manchester, England, jointly by the British Thomson-Houston Company, Ltd., Ferguson Pailin, Ltd., and Metropolitan Vickers Electrical Company, Ltd. All the equipment of the plant has been built in the factories of one or the other of these firms, to the general specifications of a committee drawn from their personnel.

New York Metal Prices

	July 31, 1934 Cents per Pound	Aug. 7, 1934 Cents per Pound
Copper, electrolytic	9.00*	9.00*
Lead, Am. S. & R. Price	3.75	3.75
Antimony	8.125	8.25
Nickel ingot	35.00	35.00
Zinc, spot	4.65	4.65
Tin, Straits	52.10	51.75
Aluminum, 99 per cent.	23.30	23.30

*Blue Eagle.

SALES OPPORTUNITIES IN NEW CONSTRUCTION

Spot coverage of the week. Projects approved and proposed, bids requested, equipment wanted, funds available. Prospects for the electrical manufacturer.

Columbus, Ind. — Cummins Engine Company plans installation of motors and controls, conveyors, regulators, electric hoists, etc., in new addition to gasoline and oil engine plant, to be used for locomotive assembling and locomotive engine work. Cost over $100,000.

Baltimore, Md. — Winand-Pikesville Distillery Company plans expansion and improvements, with installation of new equipment. Financing in amount of $788,996 has been authorized, considerable portion of fund to be used for purpose noted.

Brooklyn, N. Y.—Signal Supply Officer, Signal Corps, Army Base, asks bids until August 20 for 106,000 ft. cable and 96 reels (Circular 4).

Littlefield, Tex.—Plans electric power plant for service for city-owned pumping station, including engine-generator unit, about 9,700 ft. 6,000-volt transmission line and accessory equipment. Bond issue of $48,000 is being arranged.

Stoughton, Wis. — Plans early purchase of new Diesel engine standby electric generating unit and auxiliary equipment for city-owned electric light and power plant. Fund of $125,000 arranged. W. G. Kirchoffer, Madison, Wis., is consulting engineer.

Lyndonville, N. Y.—Speas Manufacturing Company, Kansas City, Mo., plans installation of motors and controls, conveyors, etc., in new vinegar plant. Cost about $80,000.

Independence, Mo.—Asks bids until August 21 for one 3,000-kw. turbo-generator unit, surface condenser and accessory equipment for city-owned electric light and power plant. Fund of $124,000 available. Black & Zeatch, Mutual Building, Kansas City, Mo., are consulting engineers.

Stillwater, Okla.—Purchasing Officer, Department of Interior, Washington, D. C., asks bids until August 15 for air compressor for Stillwater, with quotations on such units in lots of one to five additional.

Kenton, Ore.—Pacific Meat Company plans installation of motors and controls, conveyors, etc., in connection with rebuilding of portion of meat-packing plant, recently destroyed by fire. Loss about $45,000.

La Habra, Calif. — Has authorized surveys and estimates of cost for a city-owned electrical distribution system.

Gladewater, Tex. — Pelican Refining Company plans installation of motors and controls, pumping machinery, transformers and accessories, and other equipment for new oil refinery unit to replace plant destroyed by fire a number of weeks ago. Cost over $100,000.

Cedar Falls, Iowa—Plans construction of new transmission line in Black Hawk County for light and power service from city-owned generating plant. Application has been made for permission.

Chicago, Ill. — Armour & Company, meat packers, plan installation of transformers and accessories, motors and controls, conveyors, hoists and other equipment in new abattoir, to occupy entire block of property. Cost over $850,000.

Linden, N. J.—General Aniline Works, Grasselli district, plans installation of motors and controls, conveyors, etc., in new multi-story plant additions. Cost about $100,000.

Denver, Colo.—Bureau of Reclamation asks bids until August 20 for four flow meters for measuring water through 115,000-hp. hydraulic turbine, with one portable indicating manometer, one water manometer, cabinet, etc., and for one similar flow meter for measuring water through 55,000-hp. hydraulic turbine (Specification 623-D).

Lexington, Ky. — Schenley Distillers Corporation, New York, N. Y., has plans nearing completion for new plant, including power house, at James E. Pepper Distillery, Lexington, a subsidiary, to replace units destroyed by fire several weeks ago. Cost over $500,000. Carl J. Keifer, Schmidt Building, Cincinnati, Ohio, is consulting engineer.

Lake Providence, La. — Plans construction of transmission line for power supply for municipality. Financing is being arranged.

Ohio, Springfield — Champion Chemical Company plans installation of motors and controls, conveyors, etc., in new plant addition. Cost about $70,000. George L. Ohmart, Tecumseh Building, is architect.

Los Angeles, Calif. — Los Angeles Water and Power Bureau asks bids until August 15 for quantity of transmission line hardware for overhead conductors, including arcing rings for suspension insulators, clevis fittings, strain yokes, extension links, etc. (Specification 1462).

Lenoir, N. C.—Asks bids until August 22 for complete fire alarm system, including central station equipment, wiring for circuits, crossarms, switchboard and accessories. Macon M. Williams, engineer.

Washington, D. C.—Bureau of Supplies and Accounts, Navy Department, asks bids until August 17 for three electric arc welding sets (Schedule 3055) for Brooklyn and Sewall's Point Navy Yards; until August 21, for 40 turbine-driven forced-draft blowers (Schedule 3041) for Eastern and Western Navy Yards.

Pittsburgh, Pa.—City Controller, City-County Building, asks bids until August 20 for two large city-owned incinerator plants, with complete electrical and mechanical equipment. Estimated cost over $1,000,000.

Memphis, Mo.—Soon takes bids for extensions and improvements in city-owned electric lighting plant, with installation of equipment. W. B. Rollins & Company, Kansas City, Mo., are consulting engineers.

Warren, Ohio—Middletown Distilling Corporation, Mahoning Bank Building, Youngstown, Ohio, plans extensions and improvements in former brewery at Warren for new distilling plant. Cost over $150,000, with equipment.

MEN OF THE INDUSTRY

WILLIAM G. STEARNS, who for 22 years was connected with the Standard Underground Cable Company and its successor, the General Cable Corporation, has joined the Okonite Company as sales representative in the San Francisco office.

E. H. LIGHTNER, district manager at McDonald, Pa., for the West Penn Power Company, has been promoted to the district managership at Canonsburg. C. L. STOTLER, assistant district manager for the company at Uniontown, has been appointed district manager at McDonald to succeed Mr. Lightner.

T. J. NEWCOMB, who has been transferred from the East Springfield works to the Mansfield works of the Westinghouse Electric & Manufacturing Company, has been appointed public utility supervisor, household refrigeration sales. Mr. Newcomb's responsibilities will be the development of refrigerator business through public utilities throughout the United States.

WENDELL L. WILLKIE has been elected chairman of the board of directors of the Ohio Edison Company, operating unit of the Commonwealth & Southern Corporation. Recently Mr. Willkie had been made chairman of the board of the Consumers Power Company, the Michigan operating unit of Commonwealth & Southern.

HENDON CHUBB, head of Chubb & Son, marine insurance company, has been elected a director of the United Corporation to fill one of three vacancies arising from resignations of operating heads of three affiliated utility companies. Mr. Chubb's election was sought by the directors because of his long experience in handling large investments in connection with the insurance business.

C. C. CURTIS, since 1931 a division manager for the Puget Sound Power & Light Company, has been transferred to Stone & Webster, Inc., as personnel director for that organization. Mr. Curtis has been connected with Stone & Webster enterprises since 1907, when he entered the corporation's service at Lowell, Mass. Subsequent connections followed at Pawtucket, R. I., and Ponce, P. R. After various other assignments he was made superintendent of the Houghton County Electric Light Company at Calumet, Mich., in 1913. Two years later he was transferred to the El Paso Electric Railway Company, later to the Cape Breton Electric Company, Ltd., Sidney, N. S., and after holding an exectuive position with the Fall River properties he went with the Puget Sound company as a division manager at Seattle. Later his headquarters were at Olympia, Wash.

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H. C. Dean Assumes New Executive Duties

Harold C. Dean, general superintendent of the New York & Queens Electric Light & Power Company, was elected a vice-president of that utility at a recent meeting of the board of directors. Mr. Dean became identified with the Queens utility in 1916 as assistant to the president of the company

and one year later was named general superintendent. Prior to joining the New York & Queens company he was engaged in engineering and construction work on various public utility projects in Illinois for six years following his graduation from the engineering school of the University of Illinois. His connections included the Commonwealth Edison Company, Public Service Company of Northern Illinois, the Sanitary District of Chicago and the Department of Gas and Electricity of the city of Chicago. Mr. Dean is a member of the A.I.E.E.

JOSEPH R. MALONE, secretary of the company, was also elected to the office of vice-president. Mr. Malone has been associated with the company since 1903. He was appointed auditor in 1911, assistant secretary in 1923 and secretary in 1925. DOUGLAS BROWN was made secretary and GEORGE SUTHERLAND general superintendent to fill the vacancies.

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JOHN M. SPANGLER has been made general sales manager of National Carbon Company, Inc. Mr. Spangler has been associated with that organization singe 1915. Starting in the railroad department, he later took over the direction of western division sales with headquarters in Chicago and after a few months was appointed manager of the western division. In 1930 he became manager of the eastern division in New York, subsequently joined the general sales division and was made assistant general sales manager a year ago.

C. K. NICHOLS, commercial manager of the New York Edison Company, has in addition assumed the commercial managership of the United Electric Light & Power Company following the combining of the organizations of the commercial managers in Manhattan Borough. A. F. BERRY, formerly commercial manager with United, has been assigned to enlarged duties for both companies with the new title of assistant commercial manager.

J. H. WARDEN, sales manager of the El Paso Electric Company since 1928, has been appointed to a similar position with the Edison Electric Illuminating Company, of Brockton, Mass. Mr. Warden has been identified with the El Paso utility for the past twelve years. Starting in the engineering department, he subsequently became assistant sales manager, and then was transferred to the Gulf States Utilities Company, Lake Charles, La., remaining there as sales manager until his appointment to the sales managership at El Paso. GEORGE C. KING, merchandise manager of the El Paso Electric Company, has been appointed sales manager to succeed Mr. Warden, and ELDON WERNER, formerly identified with the Edison Electric Illuminating Company of Brockton, has been named mechandise manager in El Paso.

OBITUARY

A. V. ROCHE, consulting engineer with offices in St. Louis, Mo., died in that city July 29, after a two months' illness. He was 49 years of age. A short time ago Mr. Roche was an industrial engineer for the Union Electric Light & Power Company.

LAWRENCE H. VILAS, president of the Pyle-National Company, Chicago, manufacturer of railway supplies and turbogenerators for industrial lighting and flood searchlights, died recently of a heart attack. Mr. Vilas was born in Chicago forty years ago. He became identified with the company, which was founded by his father, in 1916. For the past two years he had been president.

HARRY R. BEETON, pioneer in the British electricity supply industry, died recently in London at the age of 83. He

was one of the founders of the old House-to-House Electric Light Supply Company, which in 1899 changed its name to Brompton & Kensington Electricity Supply Company. Besides being chairman of the company and its predecessor for more than 45 years, he was a director of two other big London electrical enterprises, the Chelsea Electric Supply Company and the London Power Company.

KENNETH E. PIPER, an electrical engineer of the Athol Gas & Electric Company, died at Orange, Mass., July 31, after a short illness. He was graduated from the Massachusetts Institute of Technology in 1933.

HERMAN G. BABCOCK, member of the Seattle electrical contracting firm of Meacham & Babcock since 1906, died of a heart attack at his home June 25. He was a native of Nebraska and had been active in electrical affairs in the Pacific Northwest for many years.

J. P. Ross, secretary-treasurer of the Birmingham (Ala.) Electric Company, died August 2 in his seventy-first year. Mr. Ross had been identified with the Birmingham utility for more than 40 years.

GEORGES VARANGOT, director of the commercial department of the Compagnie des Lampes and secretary of the French Electric Lamp Manufacturers' Association, died recently in Paris at the age of 59. Mr. Varangot was a leading French authority on electric lamps and had taken an active part in lamp standardization.

EMILIO DE STRENS, pioneer in the electric lighting industry in Italy, died recently in Milan at the age of 74. Although a Belgian by birth, Mr. De Strens was educated in Italy and lived there from his youth. As early as 1885 he obtained a concession for the electric lighting of the central part of the city of Turin. Later he became associated with the Italian branch of the Babcock-Wilcox Boiler Company.

EDMUND HAYDEN PARSONS, for 30 years representative of the Waterbury Brass Company in Rhode Island, died suddenly in Providence July 6, at the age of 73. He had made his headquarters in Providence since 1879. Mr. Parsons retired from business some years ago.

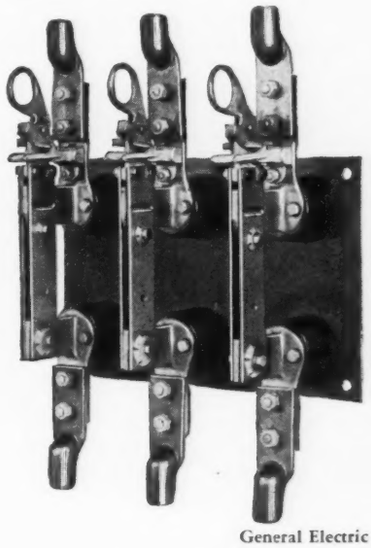
JOHN E. BARKLE, general manager f the South Philadelphia works of the Westinghouse Electric & Manufacturing Company, died suddenly July 10 at his home in Swarthmore, Pa. He was 53 years of age. Mr. Barkle had been associated with the Westinghouse company since 1901. He became works manager of the South Philadelphia works in 1929 and two years later general works manager.

NEW EQUIPMENT

Disconnects With Silver Contacts

A new line of indoor disconnecting switches, with ratings up to 1,200 amperes at 5,000 volts, featuring silver-to-silver line-pressure contacts, has been announced by General Electric's Switchgear Sales Division, Philadelphia, Pa. The silver elimina' troublesome oxidation and its inherent disadvantages. A test, consisting of 30,000 opening and closing operations, failed to harm the silver-contact surfaces.

The complete line includes hook-operated, single- and double-throw, double-throw double-blade transfer



General Electric

switches and half- or full-capacity blades, single-throw tandem transfer switches with full-capacity blades, and group-operated switches controlled manually or electrically. The single- or multi-pole switches are mounted on compound insulators and metal bases. The insulators are made of non-inflammable, arc-resisting Cetec cold-molded material and have a dry flashover of 25 kv.

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Time Switch Fits Step Rate Application

Added potentiality for usefulness is incorporated in a new Model F time switch announced by Sangamo Electric Company, Springfield, Ill. In combination with the company's Type HFS meter with two-rate register it is novel in that it accords with a new middle-west rate in which the step principle applies to both the "high" and the "low" dials. The time switch also performs the dual purpose of shifting from one register to another and of disconnecting the "off-peak" load during "on-peak" hours. It is available with synchronous motor (Form VSF) and electrically-wound (Form VWF).

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PROTECTED AGAINST CORROSION BY CADMIUM is a new line of Simplet conduit fittings announced by Simplet

Simplet Electric

Electric Company of Chicago, Ill. (5100 West Ravenswood Avenue). Space for wiring is large and easily accessible. Top surfaces are flat and surface ground to insure good fit. Burrs are removed and threads chamfered at the ends. Cover screws cannot injure the conductors.

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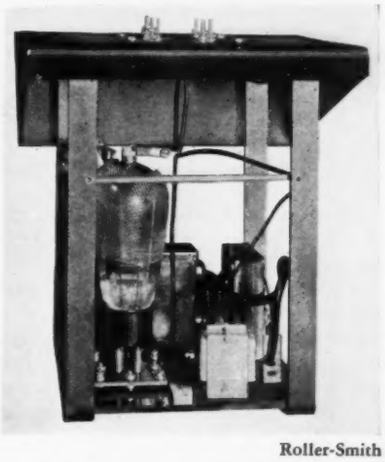
Voltage Regulator Without Moving Parts

Roller-Smith Company, 233 Broadway, New York, has developed a Kathetron voltage regulator which involves no moving parts. In series with the primary of an ordinary booster transformer is an impedance transformer with the Kathetron tube and control circuit connected across its secondary. Reflected impedance causes the grid voltage of the tube, which va-



Roller-Smith

ries with the load, to control the voltage across the booster transformer and thus its secondary contribution. Response is practically instantaneous and therefore

the flicker can be minimized even when caused by spot welders.

The regulator can be automatically compensated for power factor. It is capable of holding to two volts a variation that would be 10 or 15 volts without it. It is advocated that the regulator be placed on the primary side of the distribution transformers. The standard unit is designed for 10 per cent boost. Tube life is about 1,000 hours.

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1-Amp. Variac

A small 1-amp. Variac, consisting of an auto-transformer so arranged that the voltage is continuously adjustable in steps of less than ½ volt, has been an-

General Radio

nounced by the General Radio Company, Cambridge, Mass. The result is a smooth and linear control of voltage from line voltage down to zero. The unit is adapted for mounting in other equipment, for speed control for small motors, voltage control on rectifier units and similar applications where a fine control over a wide range is desired. A carbon brush makes contact to each turn of single-layer winding on a core of toroidal shape. The voltage can be brought to zero independently of the current taken by the connected load, and no series resistance is introduced in the line. A 5-amp. size and a 2-kva. size will follow.

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INDOOR TRANSFORMERS for luminous tube service have been announced by the Jefferson Electric Company, Bellwood, Ill. They are inclosed in a narrow style single-piece, deep-drawn case of rust-resisting steel. These transformers include such features as the patented Jefferson midpoint grounded balanced design, mica insulation, double-vacuum treatment of the complete core and coil unit, low heat rise, high silicon steel non-aging core and processed porcelain bushings. Secondary ratings range from 5,000 to 15,000 volts and from 18 to 30 milliamperes.

Porous Rubber for Battery Separators

"Exide-Ironclad" batteries are now equipped by Electric Storage Battery Company of Philadelphia with separators of "Exide Mipor." This new material is vulcanized sheet rubber with microscopic pores that permit free diffusion of electrolyte, but check active material migration.

These separators are not affected by the electrolyte solution and are immune to heat developed in a battery. They have the necessary mechanical strength to withstand vibration and the rough conditions of service to which a battery is frequently subjected. Exhaustive tests, laboratory and field, show that Exide Mipor lasts indefinitely with reduced maintenance and outstanding economy. Exide Mipor separators are used exclusively in Exide Ironclad batteries for railway air conditioning and car lighting, electric industrial trucks and switching locomotives, mining locomotives and trammers, electric street trucks and marine service.

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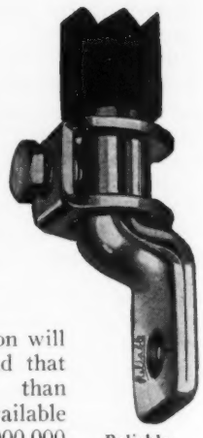
Drop-Out Fuse Switch

A drop-out fuse switch for distribution circuits is announced by the Pacific Electric Manufacturing Corporation, San Francisco, offered in three sizes: 5,000, 7,500/12,500 Y and 15,000 volts with a current rating of 100 amp. Standard type EX fuse holders are used and when the fuse blows the holder automatically drops to the horizontal position. The fuse switch is designated as type ES-3 and is equipped with interchangeable insulator units, spring contacts and a shock-absorbing stop which prevents bouncing of the fuse holder as

Pacific Electric

it drops to the open position. In order to eliminate radio interference, no current is carried through hinges or pins. All bolts on live parts are made of "Everdur." A complete description is given in the manufacturer's bulletin.

COPPER TERMINALS with clamping yokes of high-strength bronze assembled by wrench or pliers are features of new solderless lugs announced by Reliable Electric Company, 3145 Carroll Avenue, Chicago. It is claimed that vibration will not loosen them and that they run cooler than soldered lugs. Available from No. 8 to 500,000 circ.mil, they are distributed by Graybar.



Reliable Electric

ENGINEERING DATA FROM MANUFACTURERS

Bulletins and catalogues now available to engineers by manufacturers and associations.

Ways in which the **Keystone Ladder Mount** and other utility ladders made by Electric Service Supplies Company, Philadelphia, can be applied to servicing street and traffic lamps, cable hangers and potheads, service attachments, etc., are illustrated in Bulletin 376, which includes features of the ladders, dimensions, weights and prices.

Constructional features of N.E.M.A. standard **Ball-bearing Direct-Current Motors** made by the Electro Dynamic Company, Bayonne, N. J., are presented in Bulletin No. 262A.

The application, distinctive features and operation of the **Polaricode, Jr., Supervisory Control** designed especially for installations where higher cost systems are not justified are discussed in a descriptive data bulletin No. 31-575 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh. The control is available in one size only and equipped for five selective operations.

Oilproof Okocord, a Thiokol-sheathed portable cord insulated with Okonite, is described in a leaflet issued by the Okonite Company, Passaic, N. J. Resistance to gasoline, ozone and wide temperature changes are said to make it applicable to a variety of severe duties.

Equipment for various kinds of illumination with very helpful suggestions on how to apply the units most effectively are included in a set of three bulletins entitled **Permaflector Lighting, Luminaries and Floodlights** issued by the Pittsburgh Reflector Company, Pittsburgh. Data on the units such as dimensions, distribution curves, cost and parts to use with them are included. Supplementing these bulletins is a particularly well-done picturization of outstanding illumination jobs with comments on the effect and benefits produced, entitled **The Silent Partner.**